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BIOLOGICAL SIGNIFICANCE OF SOME METALS AS AIR POLLUTANTS
Part I. Lead

Health Effects Research Laboratory
Office of Research and Development
U.S. Environmental Protection Agency
Research Triangle Park, North Carolina 27711

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16. ABSTRACT

The objective of this study was to put more light on the relationship between the concentration of a metal in air and in blood of exposed persons, and biological effects which may be attributed to the exposure of a given metal.

The study was carried out at four levels of exposure to lead. The four population groups were: occupationally exposed workers, and inhabitants of industrial, urban and rural areas.

The investigation has shown that out of 9 biological parameters measured (Hb, BpE, Rtc, G-6PD, GSH, ALAD, blood Pb, ALA, coproporphyrin), concentrations of lead in blood and ALAD activity are in best correlation with the level of exposure to lead in air. The sequence in correlation of other biological parameters with lead in air is: Copro BpE ALA Hb Rtc. There was no correlation between G-6PD or GSH and air lead level.

As to the correlation between biological parameters only BpE and Rtc show a significant correlation in all groups. To some extent this is also true for ALA and Copro.

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BIOLOGICAL SIGNIFICANCE OF SOME METALS AS AIR POLLUTANTS PART I: LEAD

by

Mirka Fugas
Institute for Medical Research
and Occupational Health
Yugoslav Academy of Sciences
and Arts, Zagreb, Yugoslavia

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Project Officer

Robert J. M. Horton
Office of the Director
Health Effects Research Laboratory
U.S. Environmental Protection Agency
Research Triangle Park
North Carolina 27711

U.S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RESEARCH AND DEVELOPMENT
HEALTH EFFECTS RESEARCH LABORATORY
RESEARCH TRIANGLE PARK, N.C. 27711

ABSTRACT

The objective of this study was to shed more light on the relationship between the concentration of a metal in air and in blood of the exposed persons, and biological effects which may be attributed to the exposure to a given metal.

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ABSTRACT

The objective of this study was to shed more light on the relationship between the concentration of a metal in air and in blood of the exposed persons, and biological effects which may be attributed to the exposure to a given metal.

The study was carried out at four levels of exposure to lead in air. The four population groups were: occupationally exposed workers, and inhabitants of industrial, urban, and rural areas.

ADDENDUM TO EPA-600/1-77-041

NOTE: Probable error in one set of measurements

Since this study was completed it has become apparent that an error probably was made in analysis of the blood lead levels of the workers in the Meža Valley lead smelter. These levels are given in table 27, page 99 in line IV.4. (and elsewhere in the report) showing a mean blood lead level of 54.1µg Pb/100ml of blood accompanied by a range 33.6 to 89.8. This level was thought to be due to the fact that the workers were supplied with protective respirators and used them. However it was also noted that the blood lead levels in this group were lower than one would expect to find with the levels of other parameters in the same group. Later it was found that one batch of hydrogen peroxide employed in the laboratory for specimen preparation was causing low readings in the analysis of blood leads. This peroxide had been employed in the blood lead analysis for this one group of specimens from this study. Recently there has been a need to do additional examination of this same group of smelter workers. Blood lead determination was included in this examination. On this occasion the mean level was found to be 93µg. and the range 72-118µg Pb/100ml of blood. On the first occasion the analytic method was dithizone; on the second occasion atomic absorption was employed.

November 4, 1977
RJM Horton

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SECTION 1

INTRODUCTION

LEAD

Biological parameters -- which were expected to show lead-induced changes:

hemoglobin (Hb)
reticulocyte count (Rtc)
stippled cell count (BpE)
red cell survival time
glucose-6-phosphate dehydrogenase activity (G-6PD)
glutathione (GSH)
delta-amino levulinic acid dehydratase activity (ALAD) and lead in blood
coproporphyrin (and isomer ratio) (Copro) and delta-amino levulinic acid in urine (ALA)

The population groups -- which were used in the study of lead effects:

I. Young male inhabitants of three villages in the rural mountain district of Slovenia:

I-1 Bohinjska Bela
I-2 Bovec
I-3 Tolmin

II. Male inhabitants of the city of Zagreb, the capital of Croatia, and the largest industrial city in Yugoslavia. It is a continental town with about 600,000 inhabitants and has considerable traffic density. Since the average exposure to lead in air of most inhabitants was found to be about 1 $\mu g/m^3$, special population subgroups, which spend more time in busy streets than the average citizen, were chosen for our investigation.

Customs officers were also included in this group, even though they live in rural area, because their occupational and estimated weighted average exposure was of the same order of magnitude as that of special urban population subgroups.

The subgroups were as follows:

II-1 postmen
II-2 gas station employees
II-3 streetcar drivers
II-4 customs officers
II-5 traffic policemen

III. Inhabitants of Meza Valley, an area under the influence of a lead smelting plant. Exploitation of lead started in this area over 300 years ago and since 1907 the smelting plant has operated at the present location. The production rate is about 20,000 tons of lead per year. The stack gases were cleaned intermittently, first by electrostatic precipitators, but these became worn out and there was a period without the removal of dust from the gases. However, in 1969 fabric filters were installed, but these were out of use in the winter of 1971/72.

Male adults, living within a 5 km distance from the lead smelting plant but without occupational exposure to lead, were chosen for this investigation. Included were the inhabitants of:

Zerjav, close to the plant, with 816 inhabitants
Mezica, 4-5 km north, with 3495 inhabitants, and
Crna and Rudarjevo, 1.5 - 2.5 km SW, with 2368 inhabitants.

IV. Occupationally exposed workers in:

IV-1 lead article manufacture
IV-2 lead storage battery plant II
IV-3 lead storage battery plant I
IV-4 lead smelting plant

Investigation schedule

During the first year of the study, the development and comparative evaluation of the methods for the determination of given parameters was carried out (1).

In the second year the evaluation of methods was completed (2) and the investigation was started and continued through the third and the fourth years. In the fifth year the investigation was completed and the results processed and statistically evaluated.

SECTION 2

CONCLUSIONS

The investigation has shown that of the nine biological parameters measured (Hb, BpE, Rtc, G-6PD, GSH, ALAD, blood Pb, ALA, and coproporphyrin), the concentration of lead in blood and the delta-amino levulinic acid dehydratase (ALAD) activity correlate best with the level of exposure to lead in air. The sequence in correlation of other biological parameters with lead in air is: Copro > BpE > ALA > Hb > Rtc. There was no correlation between G-6PD or GSH and air lead concentration.

As regards the correlation between lead in air and biological parameters, only BpE and Rtc show a significant correlation in all groups. To some extent this is also true for ALA and Copro.

All other parameters correlate well only in group III, the one showing signs of elevated lead absorption which was "acceptable" to the "Statement" of some authorities.* It may be assumed that this group presents a good model for lead studies, when the concentration of lead in blood is in equilibrium with the impaired synthesis of hemoglobin.

There are some inconsistent statistically significant correlations and differences which in our opinion have to be attributed to the lack of homogeneity of certain groups, especially groups I and IV, due to variations in the background of respective subgroups.

* Diagnosis of Inorganic Lead Poisoning: A Statement, British Medical Journal 4 (1968) 501.

SECTION 3

METHODS

DETERMINATION OF LEAD IN AIR

SAMPLING

Air samples for lead analysis were collected by high volume samplers (HV), low volume samplers (LV) and personal samplers. Modified Andersen Cascade Impactors were used for the determination of the mass mean diameter of lead particles.

Membrane filters of 3 and 8 μ pore size, aluminum foils, and Munktell's 00 filters were used as sampling media.

The high volume samplers used in this study were exactly the same as used in the "Survey of Lead in the Atmosphere of Three Urban Communities" (3) and so were the filters.

The low volume samplers were the same as recommended by the OECD working group for sulphur dioxide and smoke sampling ("Volumetric apparatus") (4). Modified Andersen Cascade Impactors as described by Lee et al. (5) with aluminum foils as sampling media at the five impaction stages, and millipore filters (3 μ pore size) as backup filters, were used in this study.

Summarized data on sampling sites, methods of sampling and analysis and sampling frequency and duration are given in Table 1.

I RURAL AREA

In each of the three villages, weekly samples were collected continuously for a one-year period using a low volume sampler with Munktell's 00 filters.

II URBAN AREA

II.1. Outdoor Sampling

II.1.1 Collection of Total Mass--

Five high volume samplers were situated in the Zagreb area early in 1972, and have been in continuous operation ever since (Figure 1).

It was not possible to provide attendance of samplers during weekends so samples were collected Mondays through Fridays on a 24-hour basis.

Site No.	Characterization of the Site
(1)	High density housing, residential and commercial city center (SHP).
(2)	New part of town, south of the center, high buildings with offices or apartments, medium density housing (INGRA).
(3)	Medium density housing in western residential area interspersed with industry (CRNOMEREC or DNZC).
(4)	Medium density housing in eastern residential area interspersed with industry (VRBANICEVA).
(5)	Low density housing in northern residential area with family houses (IMI).

In the course of 1970 and 1971 two standard HV samplers with glass fiber filters were operated at sites 1 and 4 and two low volume samplers with Munktell's 00 filters at sites 2 and 5. However, the results of these measurements were not quite comparable with measurements made later, and will not be presented in this report.

II.1.2 Mass Distribution by Size--

Size selective sampling in the Zagreb area was performed at one site (IMI) for five periods at different times of the year throughout September 1971 to February 1973.

II.1.3 Sampling for Special Purposes--

In order to assess the exposure of special population groups (traffic policemen, streetcar drivers, etc.) samples were collected by battery-operated personal samplers (6) on membrane filters 8 μ, during the entire working shift.

Samples were collected through 3 consecutive days at each crossing, transport line or station, and during different times of the year.

The same sampling technique was also used for the assessment of general population ("average citizen") exposure during shopping and other activities along the busy streets of the urban center.

II.2. Indoor Sampling

Low volume samplers with membrane filters were used for indoor sampling. Integrated samples were collected for a limited period at three urban sites:

a. at site 4 (see description of sites II-1.1) for 3 periods within 6 weeks in May - July 1972 and again for 8 weeks in

winter 1972/73 in a first floor laboratory close to a moderately busy street, and in an office of the same building but facing the courtyard.

b. in the city center area in a second floor office room above a very busy rather confined street - every second week for one year (1972/73).

c. in the same area on a fifth floor living room above a busy street open to the north - for 3 periods within 6 weeks (May - July 1972), and again for 8 weeks in winter 1973.

III LEAD SMELTING PLANT AREA

III.1. Outdoor Sampling

III.1.1 Collection of Total Mass--

Five high volume samplers were situated along the Meza Valley as shown in Figure 2. The Roman numerals in the brackets, used also in the Appendix Tables, correspond to the numbers of sampling devices. Going from the north to the south the sites are:

(1) Mezice (VI) a small town close to the lead mine about 4 km north of the smelting plant.

(2) Zerjav (III) a little village around the lead smelting plant. Sampler was situated 0.5 km north of the plant.

(3) Rudarjevo (I) a small residential area, recently built about 1.5 km SW of the plant.

(4) Crna SE (V) the southeast part of Crna, an old residential town adjacent to Rudarjevo 2.0 km further south.

(5) Crna W (II) western part of Crna, 2.5 km SW of the plant.

Continuous measurements were started in November 1971, usually on a 24-hour basis, but 48-hour samples were collected occasionally and over weekends.

III.1.2 Mass Distribution by Size--

Size selection sampling in Meza Valley was performed at 4 sites for 4 periods at different times of the year in 1972 and 1973.

III.2. Indoor Sampling

Indoor samples were collected at three sites, by low volume samplers with membrane filters, during a one-year period, starting in June 1971.

The sites are shown in Figure 2. The samplers were situated in an office room in Zerjav, in a kitchen of an apartment in Rudarjevo and in an office room of the county council building in the center of Crna (CRNA C). For comparison, outdoor air samples were collected simultaneously at the same site in Crna during the same period, also by a low volume sampler. Integrated weekly samples were collected within this sampling scheme.

The two other sites had a corresponding HV sampler outdoors.

IV SAMPLING FOR OCCUPATIONAL EXPOSURE

IV.1. Collection of Total Lead

In order to assess occupational exposure of workers employed in lead industries, samples were collected by personal samplers with membrane filters usually on 3 consecutive days at each working place during the complete working shift.

IV.2. Collection of Respirable Lead

For the rough estimation of the respirable fraction of lead in the air of workrooms, simultaneous samples were collected by two stationary samplers situated side by side, one of which was preceded by a cyclone with a cutoff curve according to the specifications of the British Medical Research Council (7).

This type of sampling was carried out at characteristic working places in the lead article manufacturing and lead smelting plant.

ANALYSIS

All samples collected on membrane filter by HV, LV, or personal samplers were analyzed using atomic absorption spectrophotometry (AAS).

The sample collected by LV samplers on Munktell's 00 filters were analyzed using the ring-oven technique (RO).

Atomic Absorption Spectrophotometry

Preparation of Sample--

Samples were digested in redistilled HNO_3, the total extract or a suitable aliquot was evaporated to dryness and redissolved in EDTA solution (to prevent loss of lead due to absorption). The final solution, after being made up to a certain volume (2, 5, 10 ml or more) should have 1% EDTA and pH 8.

Analysis of Sample--

Samples were aspirated into the acetylene flame of the AAS under the following conditions:

Hollow cathode lamp:	wavelength	2170 Å
	current	6 mA
Acetylene flow		1000 ml/min
Airflow		5000 ml/min
Burner height		0.8 cm
Slit width		0.2 mm

A blank and a set of standards were run with each set of samples. The concentration of lead in the final solution (µg/ml) was read from a calibration curve and converted into the concentration of lead in air (µg/m^3). Practical sensitivity of the method using the Unicam SP 90 instrument is 2 µg Pb per 1 ml of the final solution.

Ring-oven--

Samples collected on a 1/2" diameter effective filter surface are analyzed on the ring-oven using the chromate method (8). Samples are treated with sulphuric acid in order to precipitate the insoluble sulphates and to remove the solubles. Lead sulphate is washed out with ammonium acetate to the ring zone and converted to the yellow insoluble lead chromate, the concentration of which was assessed by comparison with a set of standard rings. The method gives results comparable with those obtained by AAS analysis of samples simultaneously collected by HV sampler (9). Sensitivity of the method is 0.5 µg Pb in the sample.

DETERMINATION OF BIOLOGICAL PARAMETERS

Sampling

Blood was drawn by venepuncture into a lead-free test tube. Heparin was used as the anticoagulant. Blood samples were stored at 4°C and transferred to the laboratory. In most cases the elapsed time between blood drawing and analysis did not exceed six hours except for lead determination, which was done later.

Urine was collected through 24 hours in a dark bottle without preservative. Urine samples were kept at room temperature during sampling. As soon as the samples were delivered, 100 ml was separated for the determination of coproporphyrin and kept neutral or alkaline by addition of sodium carbonate. It was shown that this procedure stablized coproporphyrins at room temperature for at least a week. However, these samples were usually analyzed on the following day. The delta-aminolevulinic acid analyses were performed as soon as the samples were transferred to the laboratory.

Analysis

Hemoglobin--

Hemoglobin (Hb) was determined spectrophotometrically by the cyanmethemoglobin method (16). The method was checked by the standards of the International Committee for Standardization in Hematology. It has been shown that hemoglobin is essentially stable during 24 hours of blood storage at 4°C.

In a separate study the normal Hb concentration in a group of 298 healthy male adults was determined. The group was comparable in age with the groups studied. The results were as follows:

$\bar{X}$ ± SD: 15.75 ± 1.11 g/100 ml (range: 13.3 to 17.3 g/100 ml)

The reliability of the method was determined on one blood sample in ten simultaneous tests. The coefficient of variation for these analyses was 1.24%.

Hematocrit--

Hematocrit in blood samples (Htc $cm^3/\%$) was determined according to Wintrobe (17). The analysis was run in duplicate.

Basophilic Stippled Cells--

The basophilic stippled cells (BpE) were fixed and stained according to the method of Hamel (18) (using Löffler's methylene blue solution). In each blood film a total of 10,000 red blood cells were counted. The results are expressed as the number of BpE per one million of red blood cells. The upper limit for stippled cell count in unexposed subjects is $1000/10^6$E.

Reticulocytes--

The reticulocytes (Rtc) were vitally stained by 1% Brilliant-Cresyl-blue solution in ethanol and a total of 1000 red blood cells were counted in the films. The results are expressed as the number of reticulocytes per 1000 erythrocytes (E). The normal values were between 5 and 15 ‰.

The Life Span of Red Cells--

The determination of the life span of red cells was performed using Cr^{51} tagged erythrocytes according to the method of Gray and Sterling (19), with certain modifications (20,21). The normal life span is 26 ± 3 days.

Glucose 6-phosphate Dehydrogenase Activity--

Glucose-6-phosphate dehydrogenase (G-6PD) activity was measured by the method of Zinkham et al. (22). The method is based on direct spectrophotometric determination of reduced triphosphopyridine nucleotide (TPNH) in the ultraviolet region (340 nm). The activity is expressed in G-6PD units/100 ml E. One unit of enzyme is defined as the amount which produces at 340 nm an optical density change of 2.07 per minute in 3.0 ml of reaction mixture.

Normal values determined in a group of 50 healthy male adults were:

$\bar{X}$ ± SD: 182 ± 28.3 unit/100 ml E (range: 153.8 - 210.2 units/100 ml E)

The reliability of the method was determined on one blood sample. Seven G-6PD tests run simultaneously by an analyst yielded a range from 171.3-217.1 units. The coefficient of variation was 7.52%.

The stability test run at 4°C showed that G-6PD activity decreased with the time of blood storage. After five hours the average decrease in activity of seven blood samples was 1.50% (absolute decrease 2.50 units/100 ml E) and after 24 hours 5.22% (absolute decrease 8.70 units/100 ml E). Since the analyses were done as a rule within five hours, when the activity decrease was within the precision limits of the method the results were not corrected.

Glutathione--

Glutathione (GSH) was determined in whole blood by the method of Beutler et al. (23). The method is based on the development of a relatively stable yellow color when 5,5'-dithiobis-(2-nitrobenzoic acid) (DTNB) is added to glutathione. The maximum absorption for the reduced DTNB in the visible part of the spectrum has proven to be at 412 nm.

It was found that GSH is very stable. The maximum decrease of GSH concentration in seven blood samples through 24 hours blood storage at 4°C was 0.20 mg/100 ml.

The normal concentration in a group of healthy adults (N = 30) was: 35.7 ± 6.3 mg/100 ml blood (range: 26.1 - 49.5 mg/100 ml blood).

Delta-Aminolevulinic Acid Dehydratase Activity--

For the determination of delta-aminolevulinic acid dehydratase activity (ALAD) in blood the method of Bonsignore et al. (24) was used. The principle of the method is the spectrophotometric measurement of porphobilinogen (PBG) formed as a product of the enzyme action upon substrate, to which a known concentration of delta-aminolevulinic acid (ALA) is added. The activity was expressed in units/ml red blood cells. One enzyme unit is defined as the difference in the optical density between the experimental and control test tube, corrected according to the hematocrit value and sample dilution.

The validity of the method was checked by the examination of 60 subjects of whom 33 had no known exposure to lead and 27 were occupationally exposed to lead at different levels. The difference between the groups was statistically significant in accordance with lead exposure.

The reliability of the ALAD method was determined on one blood sample. Eight ALAD tests run simultaneously by two analysts yielded a range of 177 to 191 units with a mean of 183 units and standard deviation of 3.36 units. The coefficient of variation was 1.84%.

It was proven that the results are affected by the time elapsed between blood drawings and analysis. The average decrease in the activity in seven samples stored for six hours at 4°C was 4.62% (absolute decrease 5.0 units/ml E) and for 24 hours 23.15% (absolute decrease 25.0 units/ml E). Most ALAD analyses were performed within six hours, the time which does not affect the ALAD activity significantly, and therefore the results were not corrected.

Lead in Blood--

Lead in blood was determined by the "monocolor" dithizone method, which was developed in our laboratory (25,26). The advantage of this method is the elimination of iron before the extraction of lead with dithizone. The method has been used for a long time for the blood lead determination in occupationally exposed subjects, as well as in the urban and rural population.

The analyses were run in duplicate. The correlation and regression between duplicate determinations were calculated for individual days and the results are presented in Table 17.

Delta-aminolevulinic Acid--

Urine ALA determinations were performed by Davis-Andelman modification (27) using disposable, prefilled ion-exchange chromatography columns ("Bio-Rad"). The exception is subgroup 1 of group IV, where the Mauzerall-Granick method (28) was employed.

The method was checked by the spiked samples (range: 0-55 µg ALA/ml). The calibration curves were made with each new set of columns.

Coproporphyrins--

Total coproporphyrins--Samples were analyzed fluorimetrically by the method after Schwartz et al. (29). According to the original method, the urine sample, acidified by buffered acetic acid, was extracted with ethyl acetate, the extract washed with sodium acetate solution to remove uroporphyrins, coproporphyrin precursors were then oxidized with iodine, and finally coproporphyrins were extracted with several portions of hydrochloric acid.

The sensitivity of the method is 1 µg/100 ml urine. After Zieve et al. (30), the mean coproporphyin value in normal male populations, obtained by the method of Schwartz et al. is 163 ± 53 µg/day. For our normal male population, by using the same method, we obtained the value of 12.5 ± 5.8 µg/100 mg urine, which corresponds to the aforementioned values if an average daily diuresis of 1.2 - 1.5 litres is assumed.

Coproporphyrin I and III isomers--These isomers were determined by the modification of the Koskelo and Toivonen method (31). Coproporphyrins were extracted from urine with ether. A hydrochloric acid extract of coproporphyrins was purified by passing it through an aluminium oxide column which allowed the majority of impurities to pass through while retaining the coproporphyrins. The latter were eluted with ammonium hydroxide and re-extracted with ether at pH 3.5. Ether was evaporated, the dry residue was redissolved in the mixture of acetic acid and water, and ammonium hydroxide was applied on to silica gel G on thin-layer chromatography plates. The sample was developed in a mixture of 1,6 lutidine and water in an ammonia atmosphere. The stains of separated coproporphyrins were eluted with hydrochloric acid.

Owing to difficulties in the supply of 1,6 lutidine, the method was modified by using 1,4 lutidine for the separation of isomers. In addition, the chromatography chamber was saturated with ammonia to a higher concentration than in the original method. It was found that the two most critical factors, in order to achieve a quantitative separation of two isomers, were the concentration of ammonia in the chromatography chamber and the relationship between lutidine and water.

Unlike the original procedure, the isomer stains were not eluted. The fluorescence intensity of dry stains was measured directly on the Perkin-Elmer MPF-2A spectrofluorimeter (special accessory for measuring fluorescence on thin-layer chromatography plates). The excitation wavelength was 405 nm and the emission wavelength 598 nm.

Normal values of the coproporphyrin I and III proportion vary with the analytical method applied. Koskelo and Toivonen (31) have found around 25% isomer I in their normal population. Other authors consider the normal range to be 35-40% coproporphyrin I (32,33). The mean coproporphyrin I proportion obtained in our normal population was 43.3 ± 10.4%.

SECTION 4

RESULTS AND DISCUSSION

CONCENTRATIONS OF LEAD IN OUTDOOR AIR

Rural Area

Monthly arithmetic means based on weekly averages are given for all the three sites in Table A-1, as well as year averages and the highest weekly averages.

Yearly cycles of weekly averages are shown in Figure 3. Relative cumulative frequency distribution of weekly averages of lead in air are shown in Figure A-1.

It can be seen from the results that Tolmin, which is a small town, has higher concentrations of lead in air than Bovec and Bohinjska Bela, but the results are all of the same order of magnitude and are considerably lower than in the urban area.

Urban Area

Arithmetic means, based on 24-hour averages for the five urban sites (see Figure 1), are given in Tables A-2 to A-6, as well as the highest 24-hour values and number of results above 0.7 (the maximum concentration of lead permitted in open air in the Soviet Union) and 2.0 $\mu g/m^3$, both for each month and for the total one year period (1972/73). The geometric mean, standard geometric deviation, and the concentration exceeded by only 5% of the values, are given at the bottom of the tables. Yearly cycles of monthly arithmetic means are given in Figure 4. Relative cumulative frequency distributions of daily concentrations are shown in Figure A-2.

All the yearly cycles show a maximum in winter season. The differences in lead levels at the five sites are not big and they are caused more by differences in the proximity of the nearest traffic than by area characteristics. This is confirmed by eight month simultaneous measurement (1970/71) at one site close to the street and another site about 20 m away (Figure 5) with a concentration drop of 72%.

Industrial Area

Arithmetic means based on 24-hour or 48-hour averages for the five sites (see Figure 2) are given in Tables A-7 to A-11 for the year 1971/72 and in Tables A-12 to A-16 for the year 1972/73. Highest single values and number of

results above 2, 10, 50 and 100 $\mu g/m^3$ for each month and for the total one year period are also given as well as geometric means, standard geometric deviations, and concentrations of which only 5% of values are higher. Yearly cycles of monthly averages for all five sites are shown in Figure 6 for 1971/72 and in Figure 7 for 1972/73. Relative cumulative frequency distributions of daily concentrations in 1971/72 are shown in Figure A-3.

All the yearly cycles show winter maxima which are however less expressed at the two sites north of the smelting plant. The winter maxima were higher in 1971/72 than in 1972/73 which is most probably due to the deficiency in filter operation in the winter of 1971/72. Though the highest concentrations were found at Rudarjevo (highest daily mean 328 $\mu g/m^3$), the highest incidence of concentrations above 10 $\mu g/m^3$ was recorded at Zerjav, the site nearest to the smelting plant.

INDOOR CONCENTRATIONS AND INDOOR-OUTDOOR RELATIONSHIP

Urban Area

The first indoor-outdoor measurement of lead in air in Zagreb was carried out in a laboratory close to the street with a moderate traffic (II-2-a) through 3 weeks in September 1971. The average indoor-outdoor concentrations ratio was 0.46 thus in agreement with other published data (10).

The next set of data was obtained within a "total exposure study" during the same period (May-June-July) and included a living room of a home in the center of the city (II-2-c) and an office of the same laboratory building as in the first run, but facing the courtyard which give different results (Table 3). The ratio of concentrations measured inside and outside the home was again within the expected limits. But the concentrations inside the office were higher than outdoors. Therefore, an eight week simultaneous measurement, December 1972 through February 1973, was carried out indoors and outdoors at both the street side and the courtyard side of the laboratory building. The results are shown in Tables 4 and 5 and in Figure 8. They show that there is a gradual decrease in the lead concentration with the distance from the street irrespective of the building.

The eight week lead measurement inside and outside a home in the center of the city, in February-March 1973, showed practically the same average indoor-outdoor ratio as in the summer period (Table 6, Figure 10).

A one year measurement (1972/73) of lead concentration relationship inside and outside an office in the center of the city (II-2-b) gave a rather confusing picture (Table 7) since indoor concentrations were, on the average, the same as the outdoor (narrow street with dense traffic in rush hours), and the ratio varied from 0.60 - 1.76. The reason for this finding might be intensive circulation of people, frequently opened windows, and occasional heavy smoking in the room.

Industrial Area

Monthly arithmetic means based on weekly averages of indoor and outdoor lead concentrations and their ratios at the three sites in Meza Valley during a one year period in 1972/73 are shown in Table 8, as well as yearly arithmetic means of concentrations and ratios, highest weekly values and the corresponding highest 24-hour values at the sites where simultaneous daily HV-samples were collected. Yearly cycles (1972/73) of the weekly averages of indoor lead concentrations at the three sites in Meza Valley and the corresponding outdoor concentrations are shown in Figures 11, 12 and 13.

The ratios of lead in air concentrations inside and outside buildings (Figure 14) are more constant than in the urban area, and do not depend on the orientation of the front of the building towards or away from the smelting plant, which is typical for a widespread pollution from a large source.

SIZE-WEIGHT DISTRIBUTION OF LEAD PARTICLES

Urban Area

The average mass distribution of lead particles by size on five impaction stages and backup filter for the five periods of measurement, and the corresponding mass median diameters (MMD), geometric standard deviation (σ_G) and diameters (exceeded by 5% of the particles by mass) as well as the composite of the data for urban area are given in Table 9.

Graphical presentation of data is given for both urban and industrial area in Figures 15, 16 and 17 and will be discussed later.

It can be seen from Table 9 and Figure 15 that the size-weight distribution of lead particles in urban air is fairly constant and does not show seasonal variations.

Industrial Area

The average mass distribution of lead particles by size on the five impaction stages and the backup filter for three periods of measurement, the corresponding mass median diameters, standard geometric deviations and the diameters (exceeded by 5% of particles by mass) are given in Table 10. The results of the measurements made in November 1972 are not included because one separation stage was lost in one sample and another sample showed an obvious abnormality in distribution, probably due to the clogging of one of the jet plates.

The size-weight distribution of particles in the air of this area varies much more than in urban air, probably because meteorological conditions influenced the dispersion and aging of the aerosol. There is an obvious seasonal variation in particle size distribution (Figure 15) and, therefore, the composite of all the data was not calculated.

Urban Versus Industrial Area

There is a considerable difference in the size distribution of lead particles in the air of urban and industrial areas as can be seen from Table 11 and Figures 15 and 16.

The difference is not only in the MMDs but also in the range of particle sizes. The MMD of industrial lead particles is 7 times the MMD of urban lead particles, but in both areas 95% of particles have a diameter up to about 6 microns.

For comparison, data for total particles are also given. There is practically no difference in MMDs of total particles in both areas, but the range of particle sizes is again much greater in the urban area.

The average percentage of lead in total particles varies from 0.5 - 1.0 % at different sites in the urban area and within a wide range ($\bar{x}$ = 22 %) in industrial area. There is a positive correlation between the percentage of lead in total particles and the concentration of total particles in the air of industrial area (Figure 17).

EXPOSURE OF POPULATION GROUPS

General Urban Population

Exposure of an "average citizen" was calculated from indoor and outdoor lead concentrations in Zagreb air. Special measurements of exposure, during shopping and other outdoor activities, was carried out during 2 periods between 26 May and 12 September 1972. The average concentration from two integrated samples was 6.3 $\mu g/m^3$ (5.7 and 6.8). These concentrations were recorded 140 cm above the ground. In simultaneously collected samples 95 cm above the ground the concentration of lead was 33% higher, which shows that children are exposed to considerably higher concentrations of car exhausts than the grown-ups.

Special Population Groups

The results of measuring exposure to lead of special urban population groups and customs officers, while performing their jobs outdoors, are shown in Tables B-5 to B-8. The exposure of postmen was not measured, but calculated from various data on concentrations of lead in urban air.

The concentrations of lead in air to which these population groups were exposed range up to 40 $\mu g/m^3$. The highest incidence of concentrations above 10 $\mu g/m^3$ was observed with traffic policemen. However, the average exposure did not exceed 10 $\mu g/m^3$ for any of the observed population groups.

Although the exposure was measured by personal samplers the concentrations should not be considered as an evidence of individual exposure. In these groups, exposure does not depend on the behavior or working habits of the individual, but on meteorological conditions and the traffic density.

Streetcar drivers and traffic policemen do not always keep the same route or crossing, but rotate. So the average exposure of the group is at the same time the mean exposure of every single person.

Customs officers and gas filling station employees work in one place, but they move around the place, and again an average concentration of the station group is at the same time the mean individual exposure.

The relative cumulative frequency distributions of the measured concentrations are shown in Figure A-6.

Workers in Lead Industries

Lead concentrations to which workers in lead industries are exposed are shown in Tables B-11 to B-14. The values tabulated in the column "mean" are arithmetic means of the repeated measurements for one worker or for one working place, and in the column "average" are arithmetic means of all measured values within one operation or working room. Only the concentrations measured in lead article manufacture TOP (Table B-11) and lead storage battery plant Munja II (Table B-12) show the real exposures to lead, while the values measured in Munja I (Table B-13) and in lead smelter (Table B-14) are not representative of the actual exposure since practically all workers wear respirators.

The relative cumulative frequency distributions of measured concentrations are shown in Figures A-7 and A-8.

The respirable fraction of lead particles in the air of various working places in lead article manufacture was in 9 out of 14 samples over 70%, while in lead smelter, only in 3 out of 11 samples it was over 50%.

ESTIMATION OF THE TOTAL EXPOSURE TO LEAD OF THE POPULATION GROUPS (15)

Rural Population

In the rural area only outdoor concentrations of lead in air were measured, and it was supposed that the total exposure was not too different.

General Urban Population

Measurements were performed for 7 weeks at the working place, and at home and during outdoor activities for one and the same person. The resulting data were used to develop a model for the estimation of the weighted average weekly exposure of a city dweller. The calculation is shown in Table 12. Should the exposure at the working place vary from 0.5 to 2.0 the weighted average exposure would change from 0.94 to 1.30 $\mu g/m^3$. Should the concentrations at home differ from the values given in Table 12 the calculated exposure could be influenced a little more, but only in extreme cases and for a small fraction of people, living in narrow streets with heavy traffic, (see Table 9) did a significant difference occur. In such exceptional cases

the calculated weighted average exposure may reach 2 $\mu g/m^3$. Therefore, the calculated 1.1 $\mu g/m^3$ can be considered as a mean exposure to lead in air of an "average citizen".

Special Population Groups

Postmen and Other Post Office Workers--

The personal exposure to lead in air of postmen during their work was not measured but it was assessed as lower than that of streetcar drivers and gas station employees, since postmen do not spend all the time on the streets. It was anticipated that the occupational exposure of postmen might be about 3 $\mu g/m^3$ and that the rest of the exposure might be similar to that of the "average citizen." On the basis of these assumptions the weighted average weekly exposure was calculated as shown in Table 13.

Gas Station Employees, Streetcar Drivers, Customs Officers and Traffic Policemen--

The weighted average exposure to lead in air of these four subgroups calculated from the data on occupational exposure (arithmetic mean) and from the data on the exposure of "average citizen" is shown in Table 13. The calculation for customs officers differs only in the free time exposure since they live in the country at a site similar to a rural area. It has been observed that people in rural areas spend more time outdoors than the urban population, therefore hours per week spent outdoors have been doubled in the calculation.

Dwellers of Lead Smelter Area

The weighted average weekly exposure of people living in the Meza Valley was calculated from the data on the average outdoor and indoor concentrations of lead in air.

Since the concentration of lead in air in this area shows marked seasonal differences, and blood and urine samples were collected at the end of April, the average concentration in the preceding 5 months was taken as relevant for the calculation of exposure to be correlated with the biological indices of lead absorption. The results for lead in air in this period are summarized in Table 14.

Calculation of weighted average weekly exposure for the Meza Valley inhabitants, taking 0.59 as a conversion factor for indoor exposure at the working place and 0.42 for indoor exposure at home, and assuming that this population spends about 14 hours per week outdoors (mostly cold season) is shown in Table 15.

Occupationally Exposed Population

Weighted average exposure of workers occupationally exposed to lead was calculated from:

a. either the mean personal exposure or the average concentration for the occupation

b. the estimated average indoor concentration at home

c. the estimated average concentration during outdoor activities

This was not calculated for workers who wear respirators.

ESTIMATION OF AVERAGE EXPOSURE TO AIRBORNE LEAD OF EXAMINED SUBJECTS

A summary of the estimated average exposure to airborne lead of subjects whose blood and urine samples were examined and with complete biological data, by groups and subgroups, is given in Table 16.

Subgroup Exposures

Rural Area--

The exposure of subjects from rural areas by subgroups was estimated from the annual average concentration of lead in air measured at one sampling site at each of the three places in which the subjects lived.

Urban Area--

The exposure of subjects from urban area was estimated from the average of personal exposures measured during working shifts for the respective occupation.

Lead Smeltery Area--

Subjects living around a lead smelting plant without occupational exposure to lead were chosen for examination within this group. Therefore, the exposure to airborne lead in their place of living was assumed to be their critical exposure. The five month average concentration of lead in air at each place prior to blood and urine sampling, weighted by the number of subjects living at each site, was used for estimating average exposure of subjects in group III.

Since it was found out that some of the subjects within this group were either working close to the lead smelting plant or were occupationally exposed in the past, group III was divided into 2 subgroups according to the existence or nonexistence of prior exposure. Thus the data in Table 33 well describe the exposure of subgroup 1, but only partly represent the exposure of subgroup 2.

Occupationally Exposed Workers--

The exposure of occupationally exposed subjects was estimated from data obtained by personal samplers worn by the subjects or from the average exposure of workers performing the same job. Lead in air data for subgroups 3 and 4 are not reported since workers wore respirators.

Group Exposures

Group exposures were calculated from the subgroup exposures weighted by the number of subjects in each subgroup.

The results are not corrected for the nonrespirable fraction, since in the first three groups, practically 95% of particles by weight were smaller than 5 - 6 microns.

In lead article manufacture the respirable fraction of dust generated during 2/3 of the operations amounted to 70% or more of the total dust. A question is whether or not in the case of toxic dust the nonrespirable particles should be completely neglected.

RELATIONSHIP OF LEAD IN AIR TO BIOLOGICAL PARAMETERS

Individual results for all the biological parameters and all the subjects with complete data are listed by groups and subgroups in tables given in Appendix B. Lead blood results are expressed both as the original value and as the standard Hb (15.8 g/100 ml) adjusted values.

The total number of the examined subjects and the number of subjects with complete biological data used in further statistical analysis, as well as the time of blood and urine sampling, are given in Table 18.

The summarized results expressed as arithmetic means with standard deviations for all biological parameters by group and subgroup are given in Table 19.

For each parameter, the arithmetic mean, median, range of results and geometric mean, as well as the standard geometric deviation and the value exceeded only by 5% of the results for data fitting the log-normal distribution - by group and subgroup, are given in Tables 20 to 30. The arithmetic means, medians, and ranges are calculated for the 604 subjects having all the data, while the geometric means, calculated earlier, represent all the available data for one parameter. This means that there is a slight difference in the number of data from which $\bar{x}$ and M_G were calculated, but with such a large sample this should not have influenced the calculated statistics significantly. In group IV the summarized results of subgroups 1 and 2 are also presented, since these two subgroups had the only reliable exposure data.

The ratio of coproporphyrin isomers was measured for all subgroups of groups I (rural) and III (lead smeltery area) but just for two subgroups of group II (urban) and 38 subjects in subgroup 4 of group IV (occupationally exposed group). Arithmetic means with standard deviations, medians, ranges of results, geometric means, standard geometric deviations and values exceeded only by 5% of the results, by groups, are given in Table 31, both for results expressed as % of isomer I and calculated concentrations of isomer III (µg/100 ml).

The life span of Cr-51 labelled red cells was measured for 10 workers occupationally exposed to lead (Lead article manufacture) and for 12 traffic policemen. The results are shown in Table 32 expressed as arithmetic means and the ranges of the half-life of Cr-51 labelled red cells. The results for 20 subjects without known exposure to lead and for 8 subjects with clinical signs of lead poisoning are given in the same table for the purpose of comparison.

The Relationship Between Lead in Air and Biological Parameters

The relationship between the arithmetic means of biological parameters by groups and subgroups and the average exposures to lead in air expressed as arithmetic means of the critical exposure and the total weighted average exposure are shown in Figures 16-26. For quick reference, the trends, in relation to exposure levels of the biological parameters, expressed as arithmetic means of the four population groups, are shown in Figure 18.

As can be seen from Figure 18 the biological parameters used in this study could be divided into less and more sensitive indicators of low lead exposure. In low lead exposure levels, coproporphyrin isomers I and II and the hemoglobin concentration are not altered. This is also apparent from the hematocrit results. At the same levels of exposure changes in glucose 6-phosphate dehydrogenase, glutathione in blood, and delta-aminolevulinic acid in urine, are more likely to be caused by natural fluctuations than by differences in lead exposure. On the other hand, all other parameters, e.g., reticulocytes, basophilic stippled cells, delta-aminolevulinic dehydratase, including lead in blood, as well as coproporphyrin in urine suggest the influence of low lead exposure.

It appears that ALAD is the most sensitive indicator. In the urban area (exposure level II) the average ALAD activity amounts only to half the value found in the rural area (exposure level I). The average blood lead concentration is higher in the urban than in the rural area, although this increase is not as high as would be expected from the ALAD data. There are probably some other factors in addition to the differences in lead exposure responsible for the differences of ALAD activity in these two groups.

The concentration of total coproporphyrin in the urine is higher in air lead exposure level II than in exposure level I, and so is the copro III isomer concentration, but the copro I/copro III ratio (expressed as copro I %) is not significantly altered.

The average number of Rtc and BpE follows the increase of air lead exposure. The results of BpE are very scattered and the difference is not significant.

At air lead exposure level III, which could be characterized as the intermediate exposure, but approaching the safe occupational exposure, the response of biological parameters follows the trend observed at previous exposure levels. The ALAD activity persistently decreases in a curvilinear manner, and the blood-lead concentration increases to about three times the concentration found in the urban area. Total coproporphyrin continues to ascend to higher levels, while the percentage of copro I isomer declines. The excretion of ALA goes up significantly. The average number of Rtc and BpE continues to increase. There was no change in the hemoglobin concentration. The average G-6PD activity and GSH concentration oscillate within natural variations.

At air-lead exposure level IV, i.e., at occupational exposure, changes in ALAD activity and lead in the blood, coproporphyrin and ALA in the urine continue to reflect the difference in exposure. There is a stagnancy in the average number of BpE and Rtc. The hemoglobin concentration decreased a little, which is also reflected in the hematocrit value. The G-6PD activity and GSH concentration continue to fluctuate.

Correlation of biological indices of lead-induced changes, with four exposure levels to lead in air, is shown in contingency tables B-15 to B-25. Hematocrit data were not taken into account as the direct determination of hemoglobin is a more precise index of the Hb alteration. In addition to the rank correlation coefficients, quadriserial correlation coefficients were also computed (Table 33). For the more relevant parameters, rank correlation coefficients were also calculated from logarithms of biological indices, but only in the case of total coproporphyrin was a better correlation obtained in this way. The quadriserial $\underline{r}$ is a better correlation measure when one variable is divided into four categories while the other variable is quantitative. In both cases the highest correlation with the level of exposure was obtained for ALAD and lead in blood. The sequence in order of the quadriserial correlation coefficients is as follows:

$$\text{ALAD} > \text{Pb}_{\text{blood}} > \text{Copro} > \text{BpE} > \text{ALA} > \text{Hb} > \text{Rtc}$$

The correlation coefficients for copro-isomers cannot be directly compared with the others since in group IV, isomers were measured only in subgroup 4 with the highest exposure, and this may positively influence the correlation. There is no correlation between G-6PD or GSH and air-lead levels.

The high negative correlation between lead in air and ALAD, as well as the high positive correlation between lead in air and lead in blood, signify ALAD and lead in blood as the biological parameters with a quick response to the air-lead exposure. The others, e.g., coproporphyrin, ALA, BpE, Rtc and Hb are less affected by the exposure to lead by they do not reflect the dynamic responses of the organism to the absorbed lead, and therefore the intensity of changes is influenced b the rate of absorption, excretion, and retention.

The relationship between lead in air and biological parameters is also illustrated in Figures 19-26. In these figures the concentrations of lead in air are expressed in numerical values both as arithmetic means of measured exposures and as the total weighted average exposure of groups and subgroups. While in Figure 18 only trends are shown, in Figures 19-26 the relationship can be followed quantitatively. The results presented in this way show the same general trend as observed in Figure 18. This presentation, however, shows that subgroup 1 of group III fits well into the trend, while subgroup 2, though apparently less exposed, shows biological findings of the same order as the moderately exposed subjects of group IV.

Differences in Biological Parameters

In Table 34, the analysis of variance between and within groups, and in Table 35, the coefficients of variation by subgroups, for all biological parameters are presented.

Differences Between Examined Groups

Highly significant differences between the groups were found for all biological parameters. The analysis of differences between every two groups (t-test) has shown that there is a difference between all four groups in ALAD, Pb, ALA, coproporphyrin and copro III isomer. Rtc and BpE differed significantly in the first three groups but there was no significant difference between group III and group IV. On the other hand, group IV was responsible for differences in Hb between groups. Differences in G-6PD was due to group II. For GSH there were no significant differences between group IV and groups I and II, but all other differences were significant.

Differences Within Examined Groups

In group I, consisting of male inhabitants of three rural mountain districts, statistically significant differences among the subgroups were found in four biological tests: G-6PD, GSH, Pb and ALA. The analysis of differences between subgroups taken two by two (t-test) has shown that in case of G-6PD, Pb and ALA, the difference is caused by subgroup 1 which had systematically lower values for all the three parameters than did subgroups 2 and 3. In case of GSH, only subgroup 3 had systematically lower values.

For the difference in G-6PD and GSH, we have no plausible explanation. It may be assumed that it is due to natural oscillations. As can be seen from Figure 18, there is no trend to higher or lower values of G-6PD and GSH with increasing lead exposure. The differences in blood lead, which is also reflected in urine ALA concentration, may probably be attributed to the different ingestion of lead through the variation of food. It is true that subgroup 1 has also the lowest exposure to lead in air, but it is hard to believe that such a small difference in the air lead (see Table A-1) can cause a statistically significant difference in blood lead.

Group II, which comprises the urban population, is a rather heterogeneous group. The analysis of variance showed statistically significant differences among subgroups of group II for almost all parameters (Table 34). A more detailed analysis of differences among the subgroups has shown that subgroup 3 (streetcar drivers) differs from other subgroups by higher blood lead, lower ALAD and Hb values. On the other hand subgroup 3 has lower Rtc and BpE count than the other subgroups, and higher GSH.

Subgroup 4 (customs officers) differs from other subgroups by higher ALA, coproporphyrin, BpE and Rtc values. Hb is also lower than in the remaining three subgroups. Subgroup 1 (postmen) has higher G-6PD and ALAD values than the other subgroups and lower GSH and ALA values. However, blood lead, although lower than in subgroup 3, is higher than in other three subgroups.

The most plausible explanation for the differences in at least some of the parameters compared is not the present exposure to lead in air, but differences in background, socioeconomic status, place of residence, working time, diet, drinking habits etc.

For instance, streetcar drivers (subgroup 3) are mostly recruited from poor villages; they work day or night shifts in rotations, and do not take regular meals, and the fluctuation is rather high.

Customs officers live in the country; they also work in shifts, but their socioeconimc status is much better.

Therefore, although the differences in biological parameters between subgroups of group II are statistically significant, the total variation within the group can be considered as a natural oscillation.

In group III, subgroups 1 and 2 differ significantly in ALAD and Pb in blood and ALA in urine. The difference in urinary coproporphyrin is not statistically significant due to the great dispersion of results in both subgroups (see Table 35).

There is no difference in Hb, GSH and G-6PD which may indicate that this group is homogeneous as to the background, socioeconomic status and life habits. The differences are only in those parameters which reflect influence of lead, and the absolute levels of these parameters are in the region of elevated lead absorption. Therefore, it is justified to conclude that the differences are caused by different exposure to lead. As a matter of fact, the criterion for dividing Meza Valley inhabitants into two groups was whether there is, or ever has been, any exposure to lead in air in addition to that endemic to the area. All those who were previously occupationally exposed to lead or are occasionally working in, or close to, the lead smeltery plant were grouped in subgroup 2.

In group IV, the difference among subgroups is mainly due to subgroup 4, the one with the highest exposure. The workers of subgroup 4 have the lowest Hb concentration and ALAD activity, the highest number of BpE and Rtc and the highest excretion of ALA and coproporphyrin by urine. However, the blood-lead content was not highest in subgroup 4, but in subgroup 3.

G-6PD values are significantly lower and GSH values are significantly higher in subgroup 4 than in others. As mentioned before, these differences could not be related to lead, but to the natural oscillation. Subgroup 4 of group IV lives in the same area as group III and in a similar geographic and ethnic region as group I. All the subjects from these groups (except I-1) have very similar levels of GSH (39-41). Populations living in Zagreb and vicinity like group II and subgroup 1, 2, and 3 of group IV have GSH levels between 34.4 and 37.6. The G-6PD values shows similar differences although less pronounced.

The Relationship Between Biological Parameters

The relationship among different biological parameters was first tested by groups and for all subjects using the Pearson coefficient of correlation (Table 36). However, since there is a significant difference between the means of the groups, and even of some subgroups, it is not correct to calculate a common correlation coefficient, as it may be misleading because the

general trend may mask the true association. Therefore, averaged coefficients of correlation were calculated for all subjects (Table 37) and separately for groups III (Table 39) and IV (Table 39), in which differences in biological parameters should be associated with different degrees of exposure to lead. Comparison of the data in Table 36 with those in Tables 37-39 shows clearly how erroneous conclusions can be if based on wrong statistics.

An additional difficulty is that the distribution of some parameters was close to normal at two lower levels of exposure but log-normal or irregular at higher levels of exposure. That was one of the reasons that the correlation between the parameters deviated more or less from the linear. In some cases a better correlation was obtained by taking logarithms of one or both parameters.

Correlation between Biological Parameters of the Whole Population--

There is very little correlation between biological parameters of the whole population (Table 37). Beside the high correlation between Bpe and Rtc and significant correlation between coproporphyrin and ALA in urine, there is a very low correlation of ALA with BpE, of log ALAD with log ALA and log BpE, as well as of Pb in blood with log BpE, Hb and ALA. No correlation was found between ALAD and Pb in blood. These findings might be explained by the dynamic relationship between the biological parameters examined which may be different at different exposure levels.

Correlation Between Biological Parameters Within Groups--

As previously stated, the correlations within groups III and IV have been studied in more detail.

Group IV--As can be seen from Table 39 except for BpE/Rtc and coproporphyrin/ALA very little correlation was found between biological parameters in group IV. A low but significant correlation was found of Hb with BpE, Rtc, blood Pb, ALA, and coproporphyrin. BpE and Rtc were in correlation with blood Pb and ALA. There was a very low correlation between blood Pb and ALA as well as between Rtc and coproporphyrin.

When linear correlation coefficients were calculated there was con correlation between ALAD and any other parameter, but when logarithms were used for calculations, the correlation between ALAD and ALA became significant.

Group III--Again, a very high correlation was obtained between Rtc and BpE, and between coproporphyrin and ALA (Table 38). Also for this group, a very significant correlation of log ALAD with blood Pb, log coproporphyrin and log ALA was obtained. Correlation of ALAD with BpE and with Rtc was also significant.

In addition to log ALAD, Pb in blood was in significant correlation with Hb. There is a low but significant correlation of blood Pb with BpE, Rtc, log ALA and log coproporphyrin. Further, a low, but significant correlation was found of BpE and Rtc with ALA, coproporphyrin and G-6PD and of coproporphyrin with GSH.

For this group, contingency Tables B-15 to B-39 and scatter diagrams (Figures 21 to 36) are given.

Life Span of Cr-51 Labelled Red Cells

The results presented in Table 32 show that there is a significant difference in the half-life of red cells among subjects without known exposure, subjects with moderate occupational exposure and subjects with clinical symptoms of lead poisoning. But the group of traffic policemen showed practically no difference in the red cells half-life as compared to the occupationally exposed group, although exposure to lead in air was considerably lower as confirmed by other biological tests.

However, irrespective of results, in our opinion this test is not suitable to be used widely as an early indicator of lead exposure.

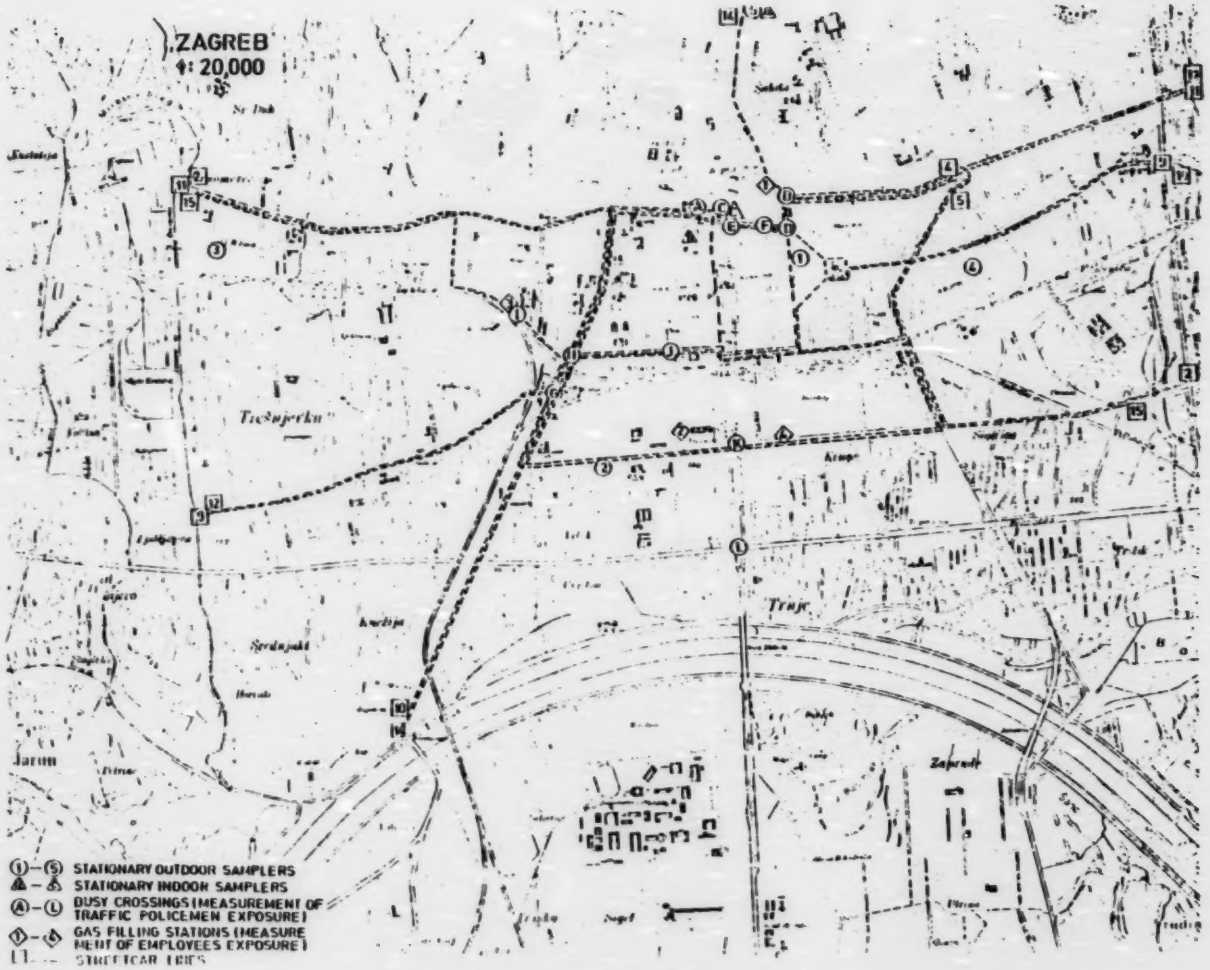

Figure 1. Map of Zagreb.

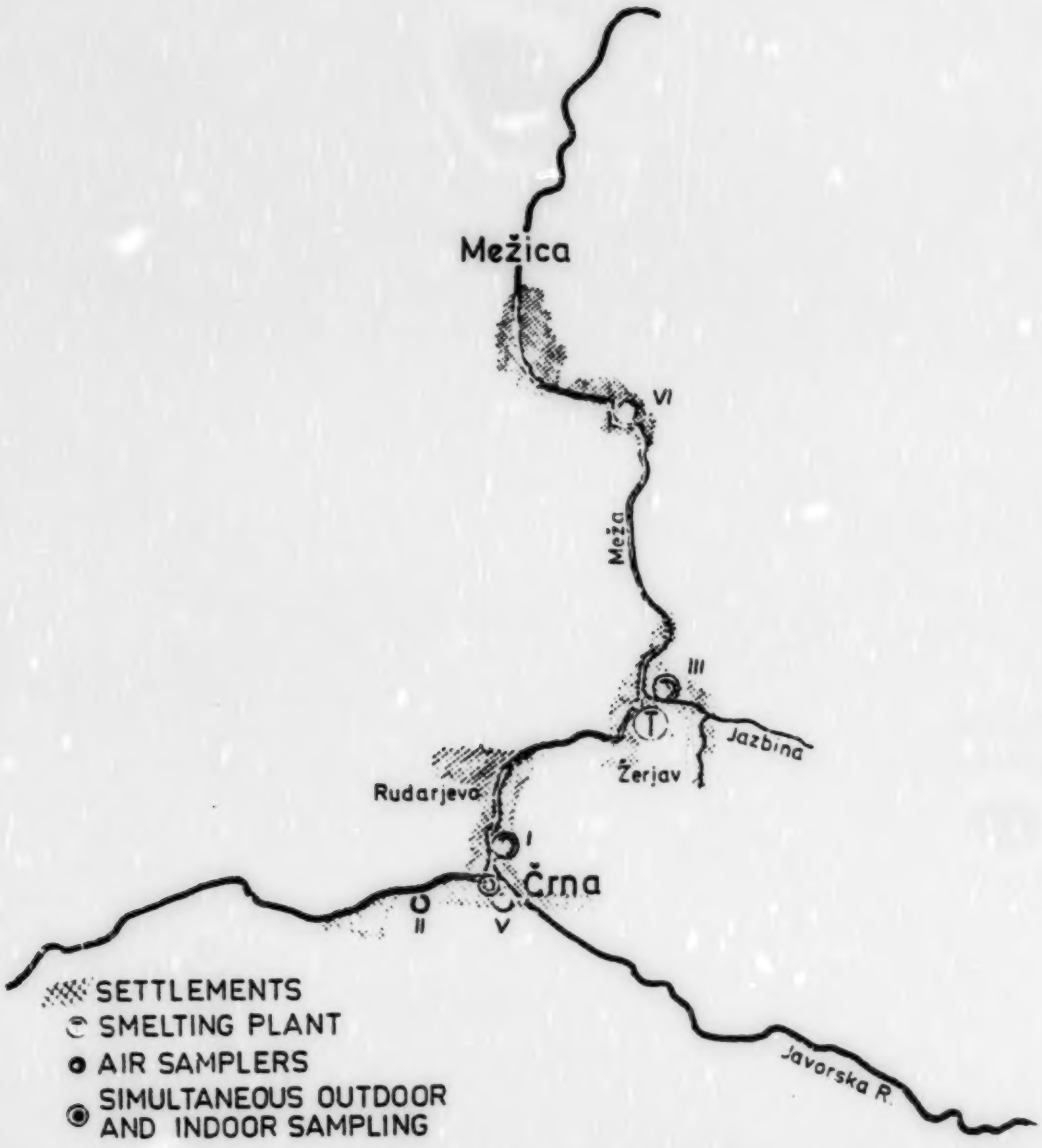

Figure 2. Location of smelting plants settlements and air sampling in Meza Valley.

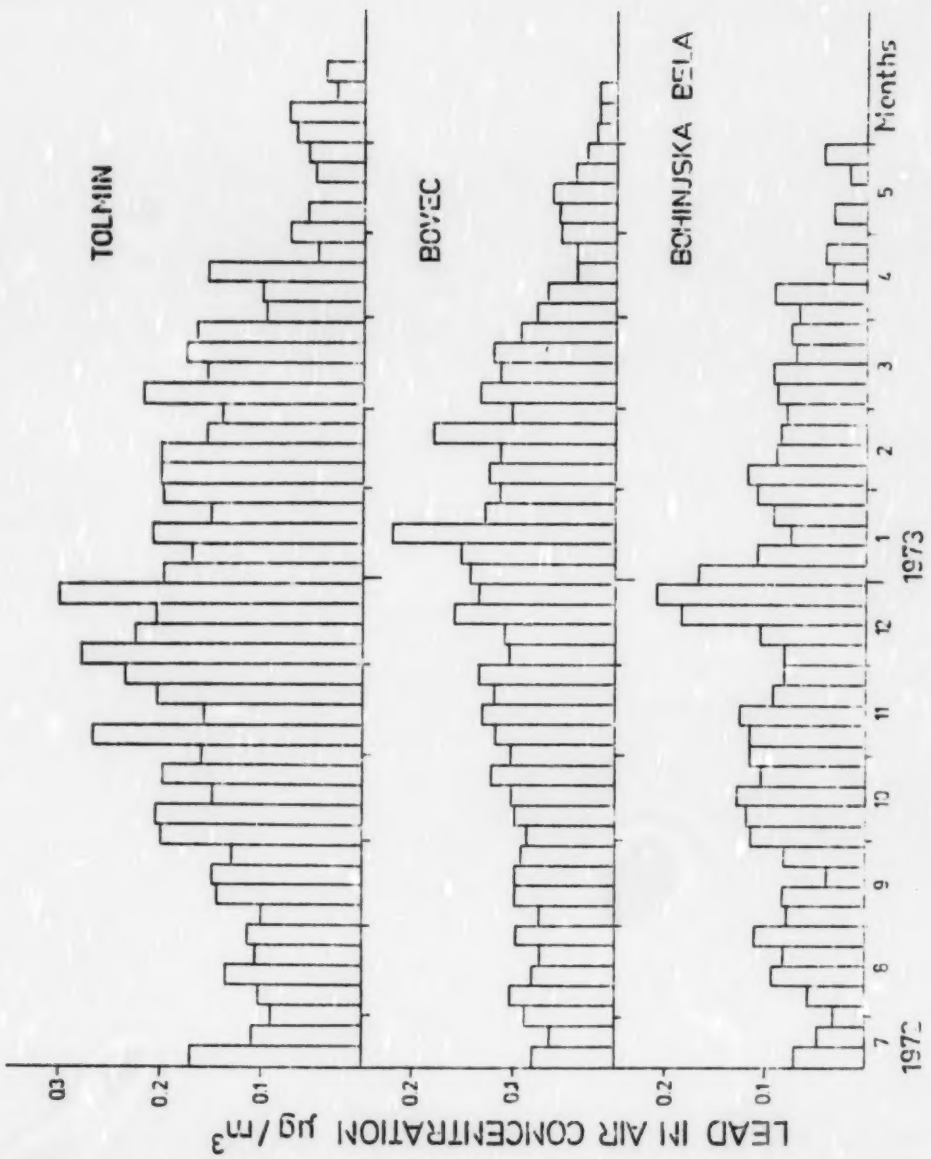

Figure 3. Atmosphere lead concentrations in rural areas.

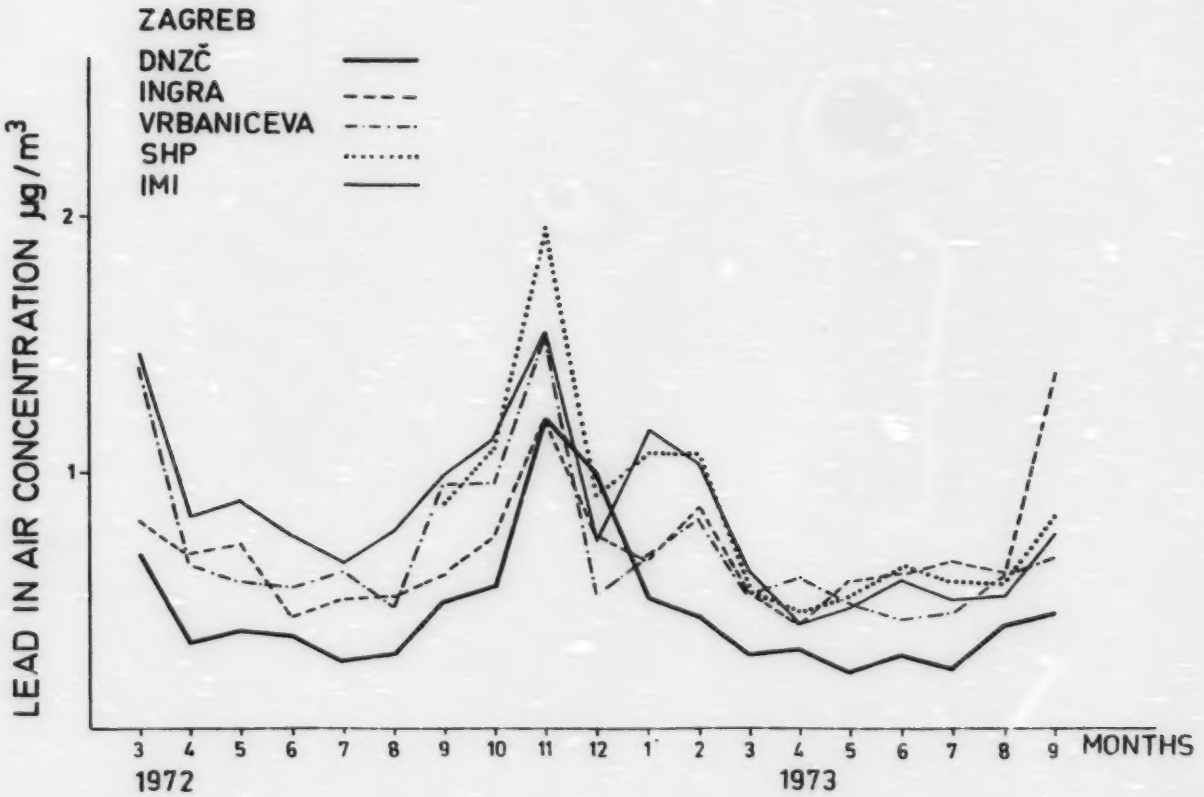

Figure 4. Mean monthly concentrations of lead in air.

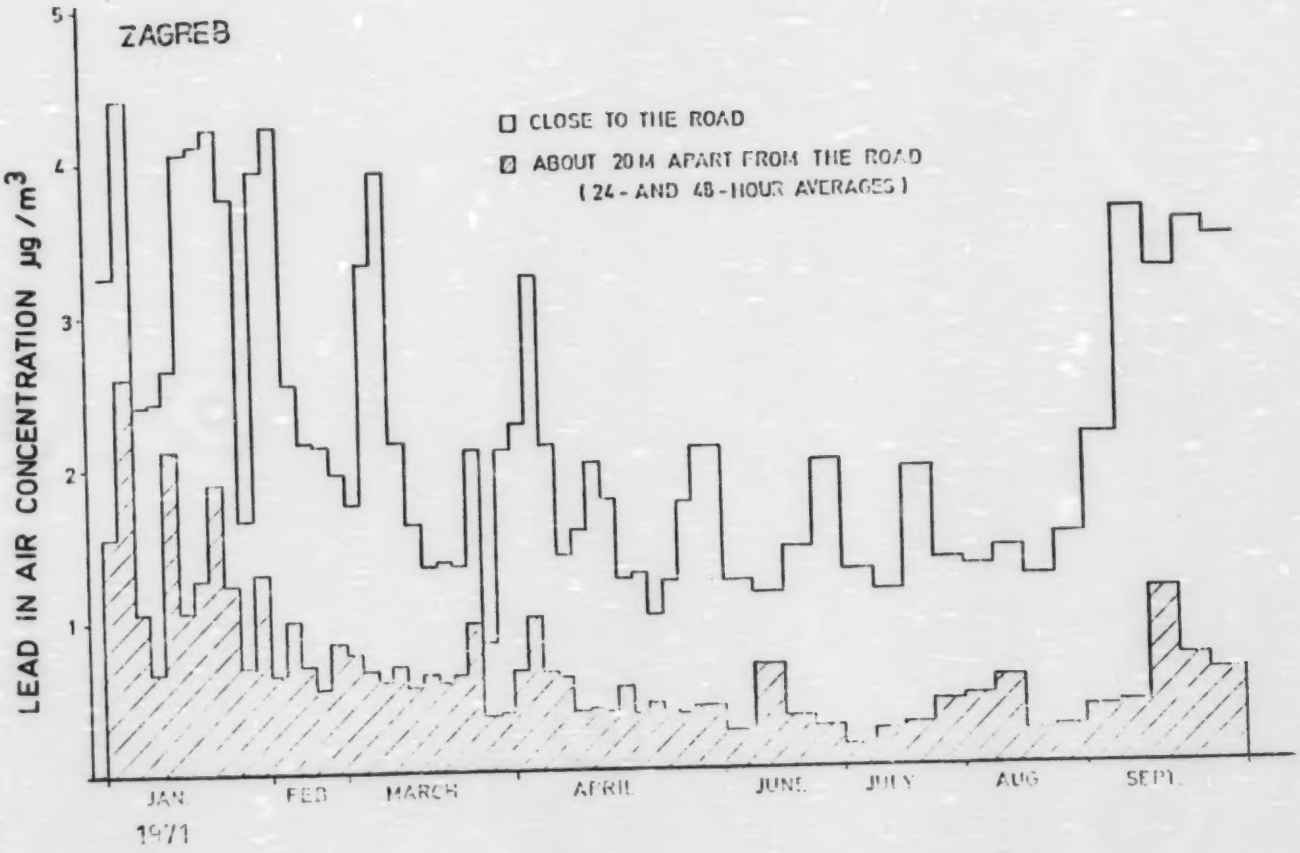

Figure 5. Concentration of lead in air at a site with low density housing.

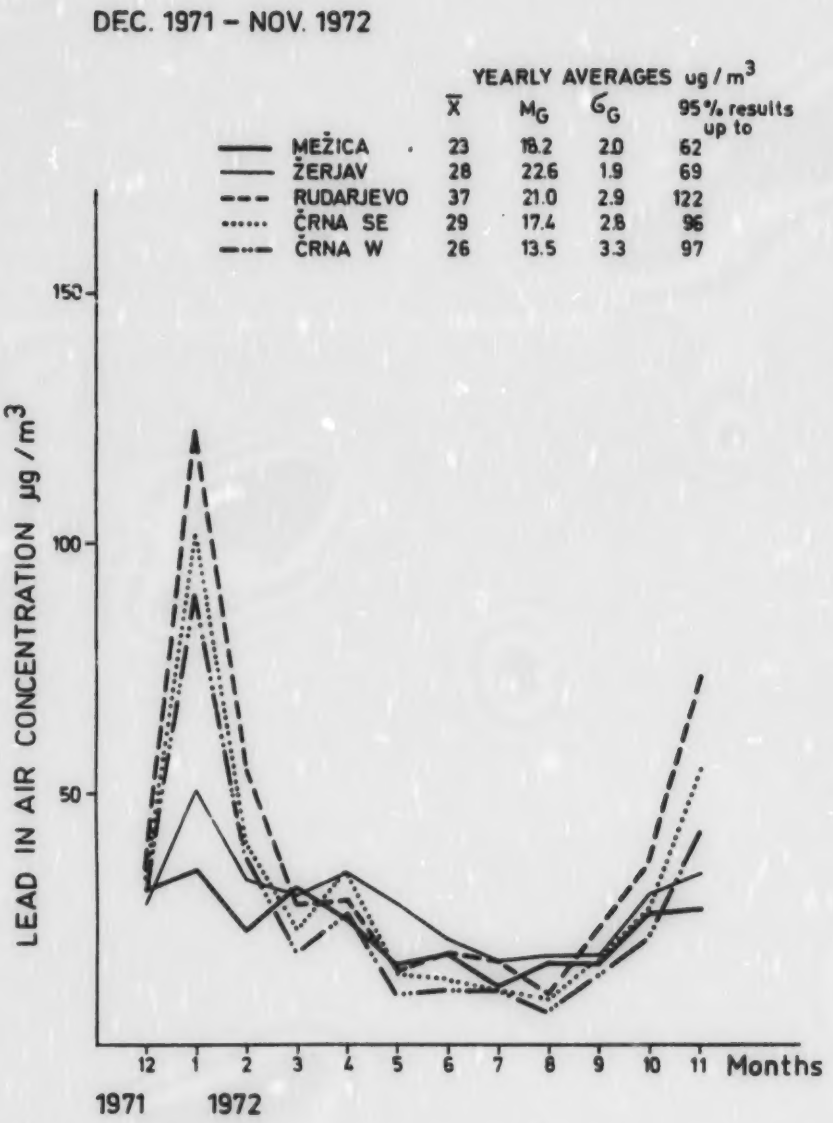

Figure 6. Monthly averages of lead in air concentration in Meza Valley.

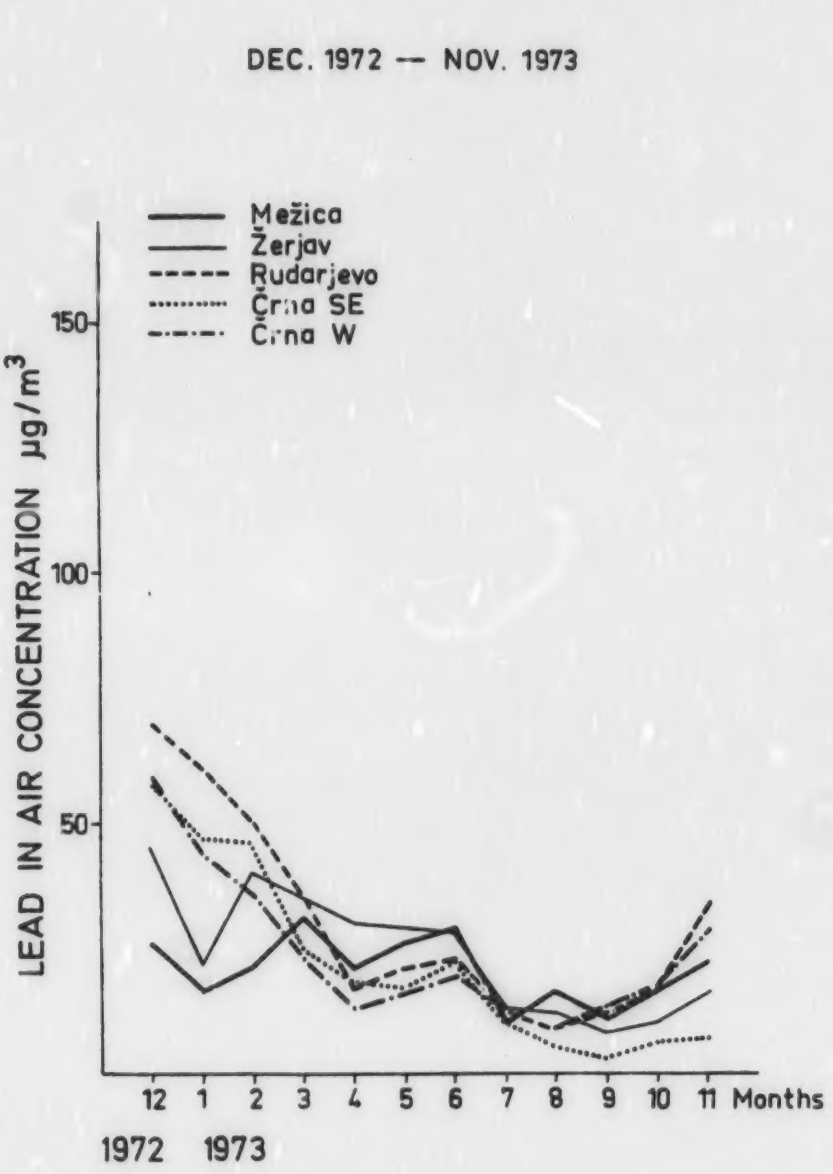

Figure 7. Monthly averages of lead in air concentration in Meza Valley.

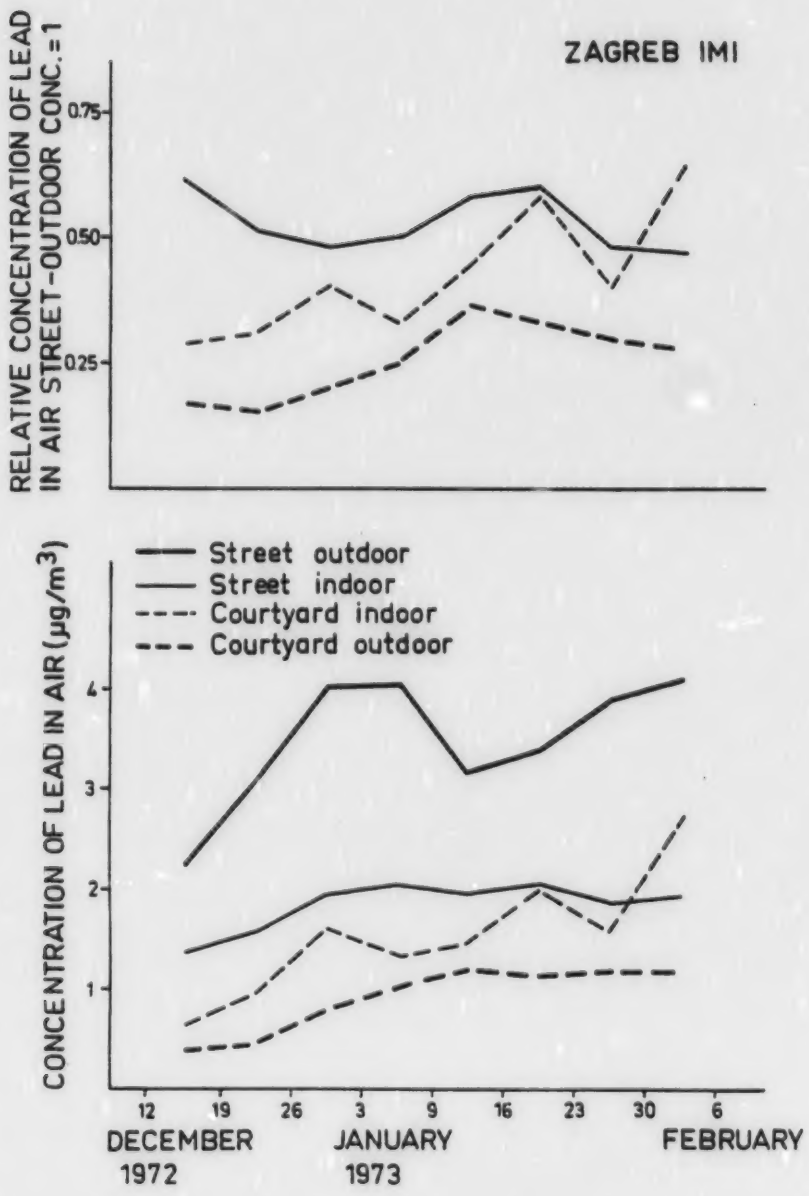

Figure 8. Indoor-outdoor relationship of lead in air concentration, Zagreb IMI.

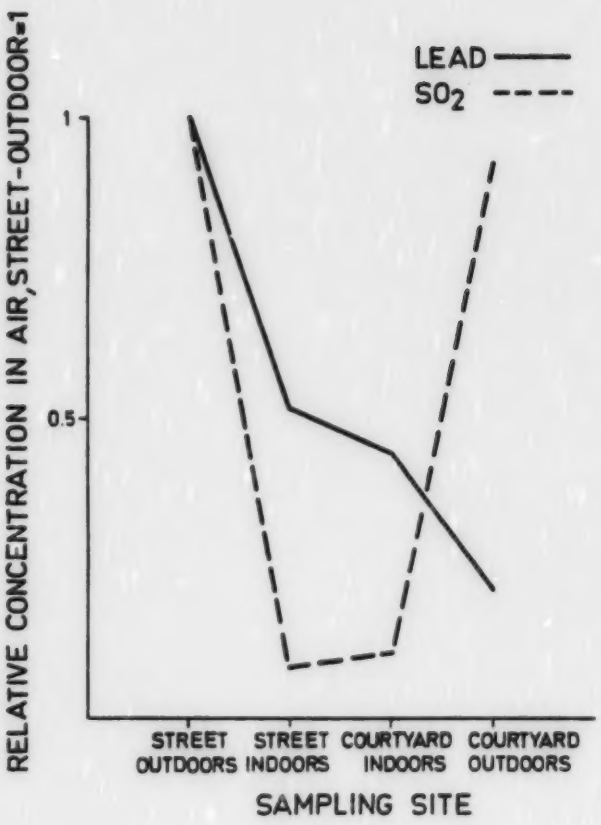

Figure 9. Indoor-outdoor relation of lead compared to SO_2 concentrations.

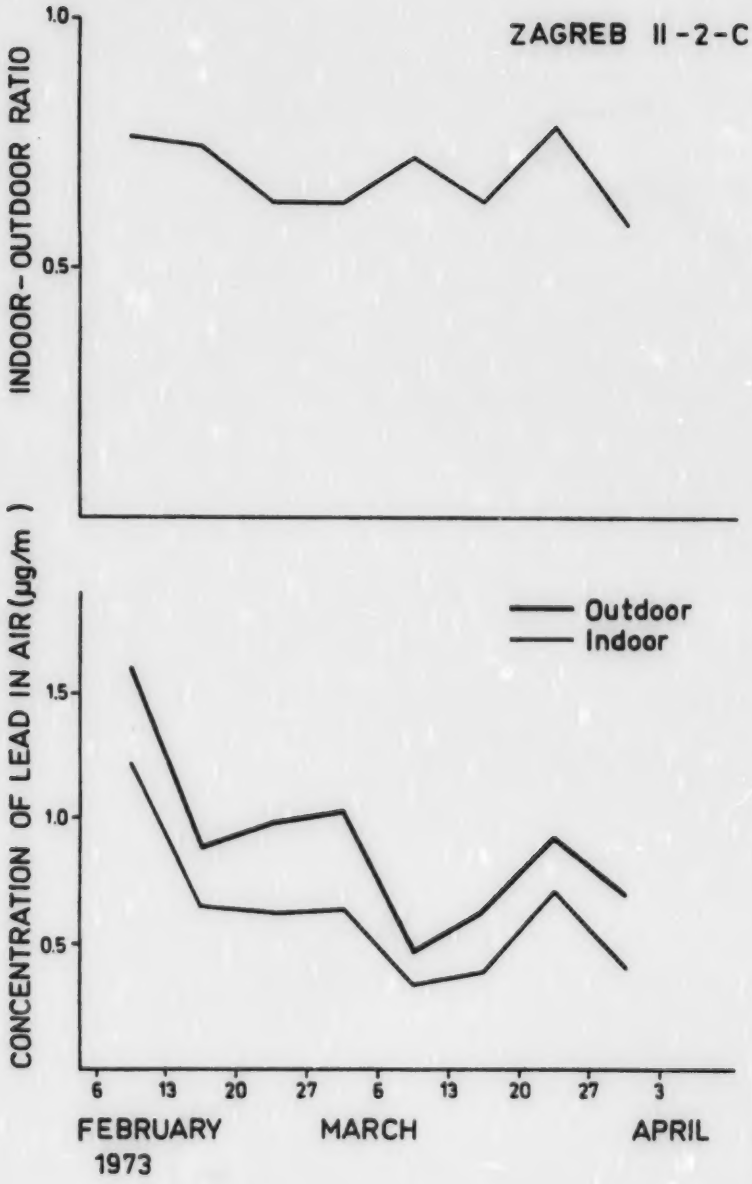

Figure 10. Indoor-outdoor relationship of lead in air concentration, Zagreb II-2-C.

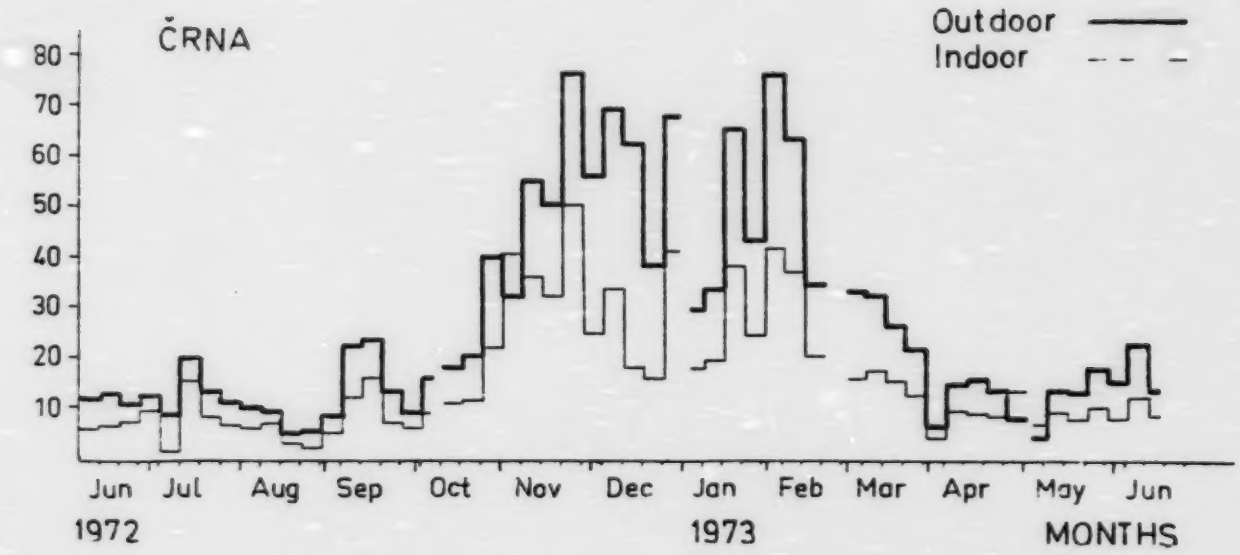

Figure 11. Yearly cycle of weekly averages outdoor and indoor lead concentrations in Meza Valley, Crna.

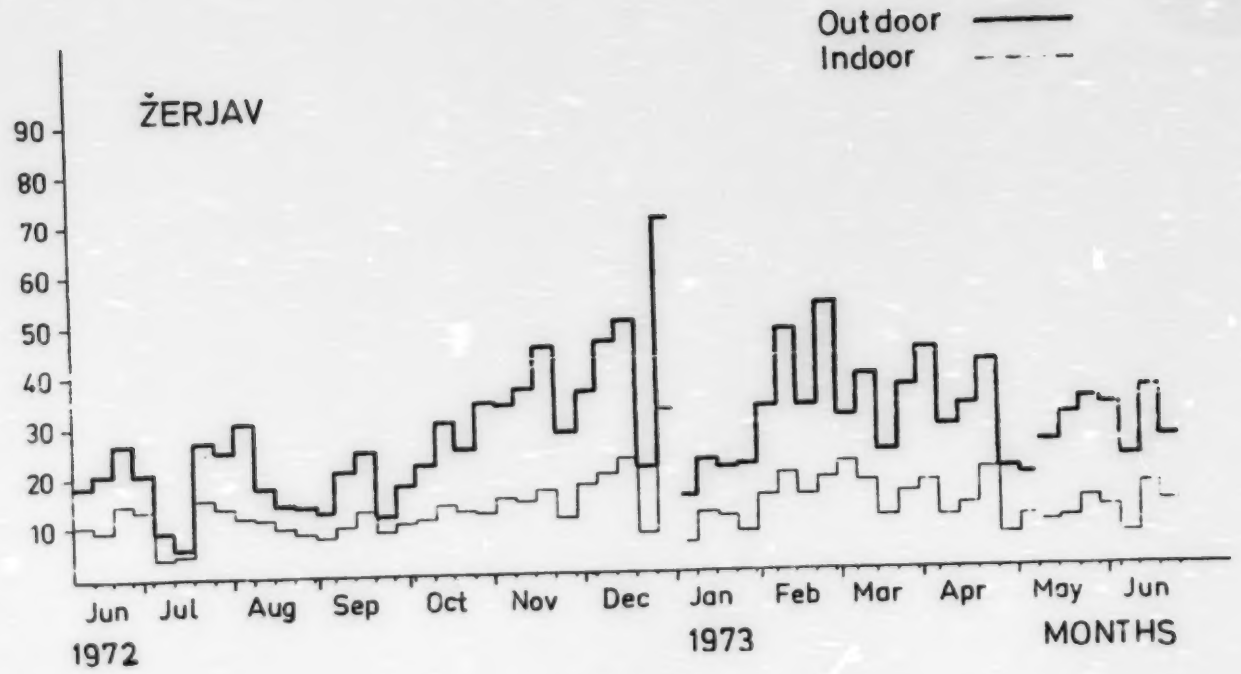

Figure 12. Yearly cycle of weekly averages outdoor and indoor lead concentrations in Meza Valley, Zerjav.

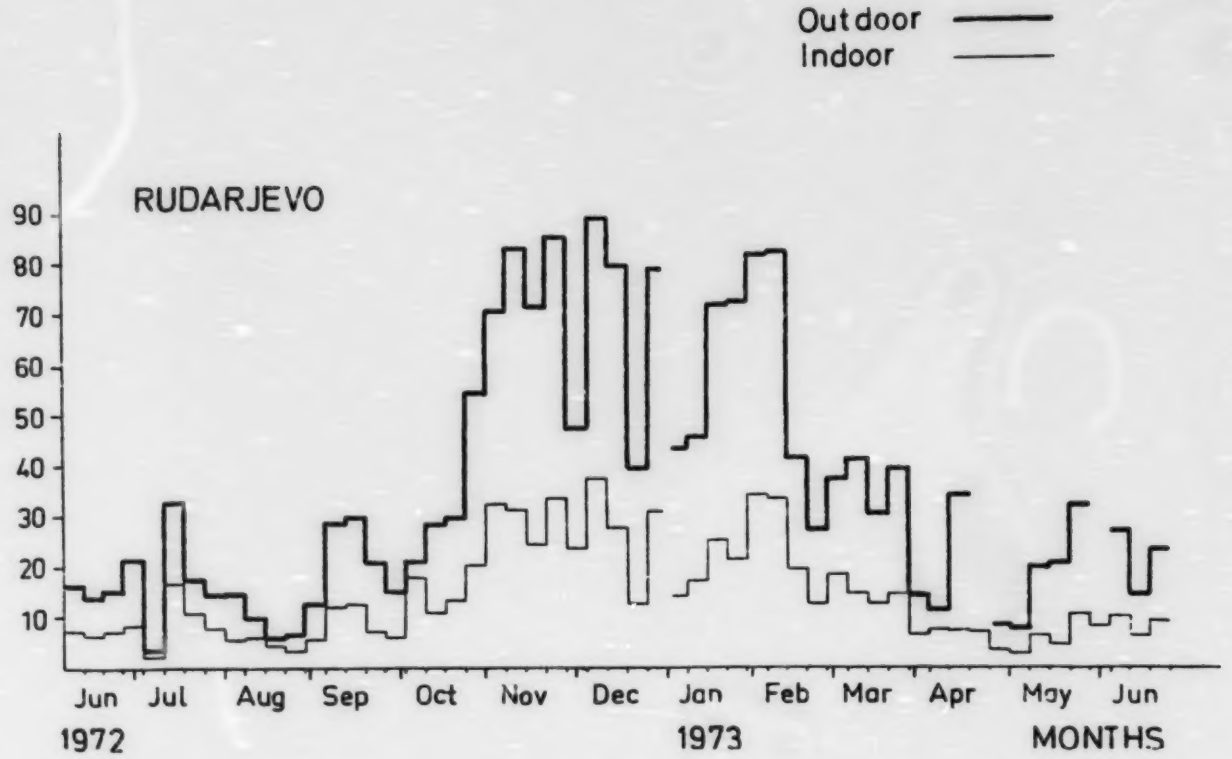

Figure 13. Yearly cycle of weekly averages outdoor and indoor lead concentrations in Meza Valley, Rudarjevo.

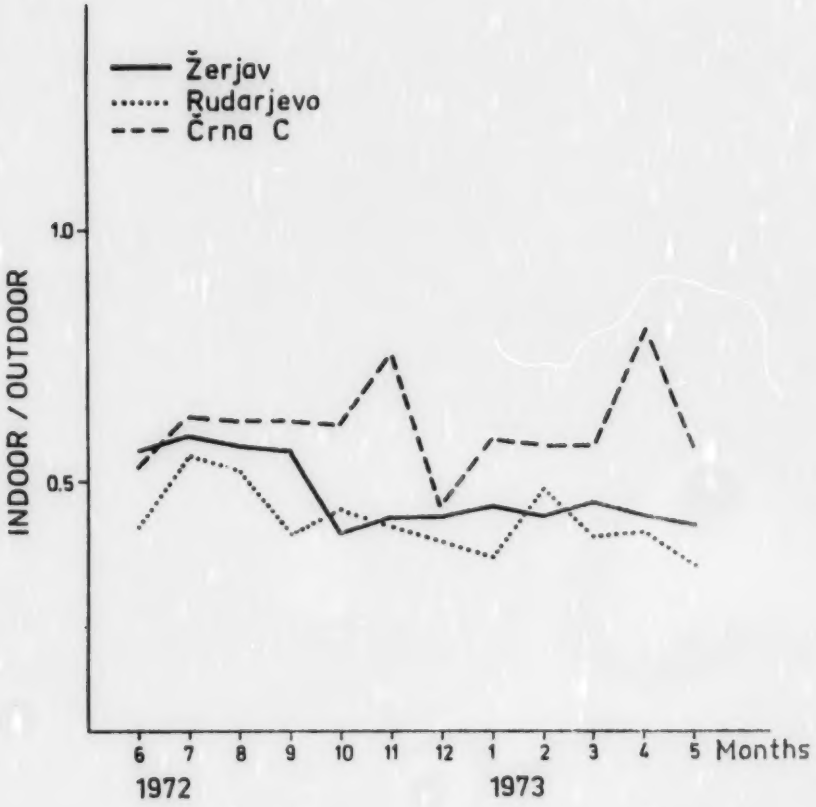

Figure 14. Indoor-outdoor ratio of monthly arithmetic means - Meza Valley.

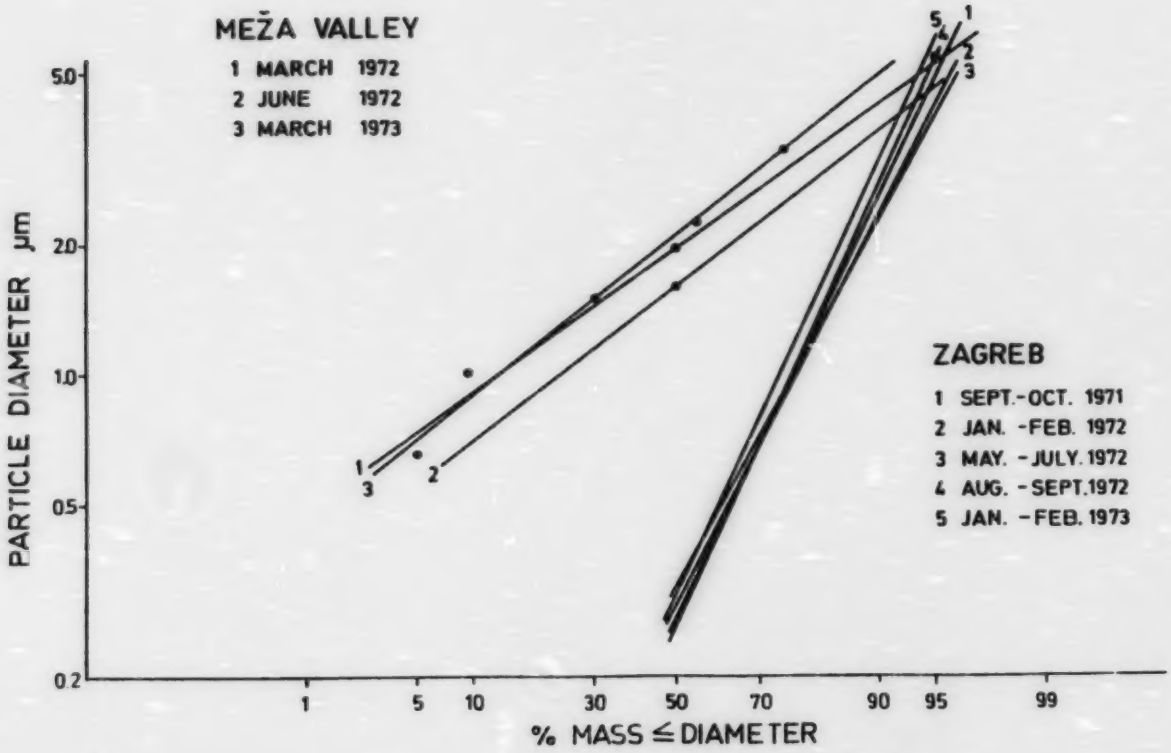

Figure 15. Cumulative mass distribution of lead particles by size.

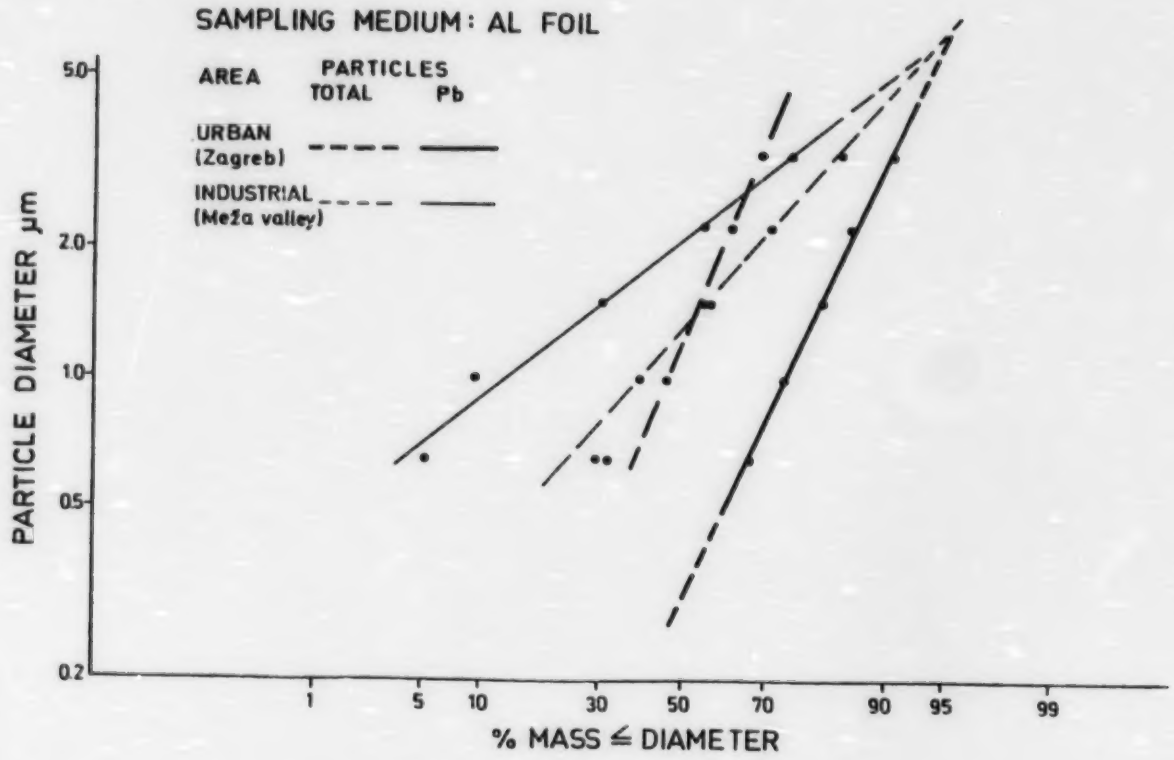

Figure 16. Cumulative mass distribution of total and lead particles by size.

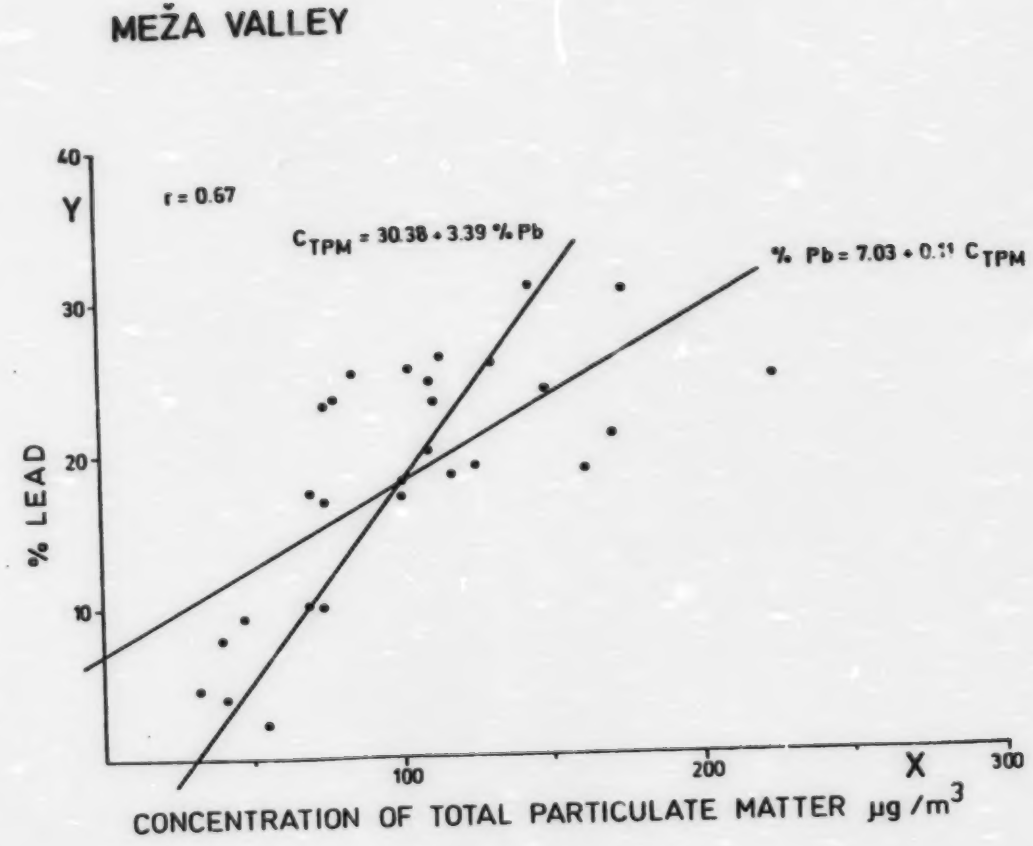

Figure 17. Percent lead in total particulate matter in relation to the concentration.

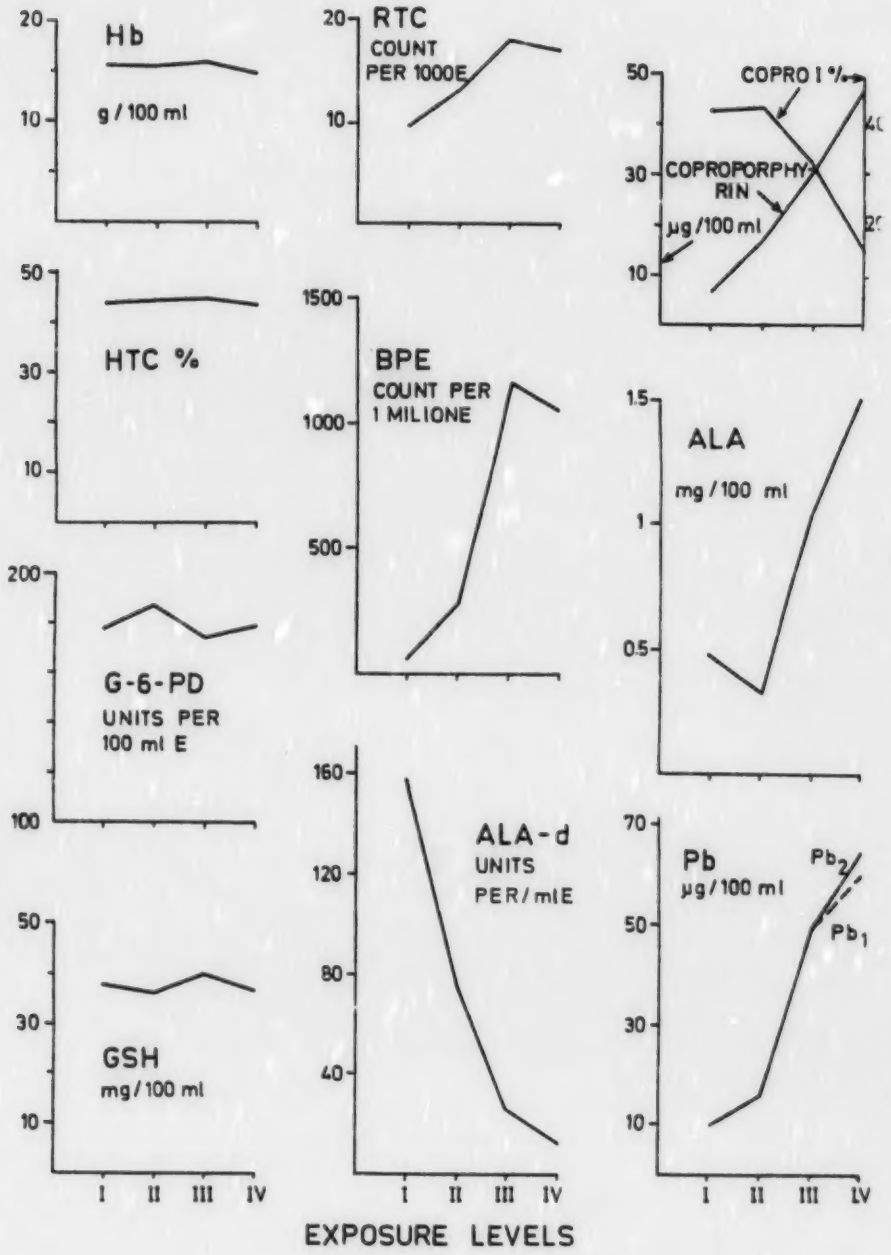

Figure 18. Trends of biological parameters with exposure levels arithmetic means of four population groups

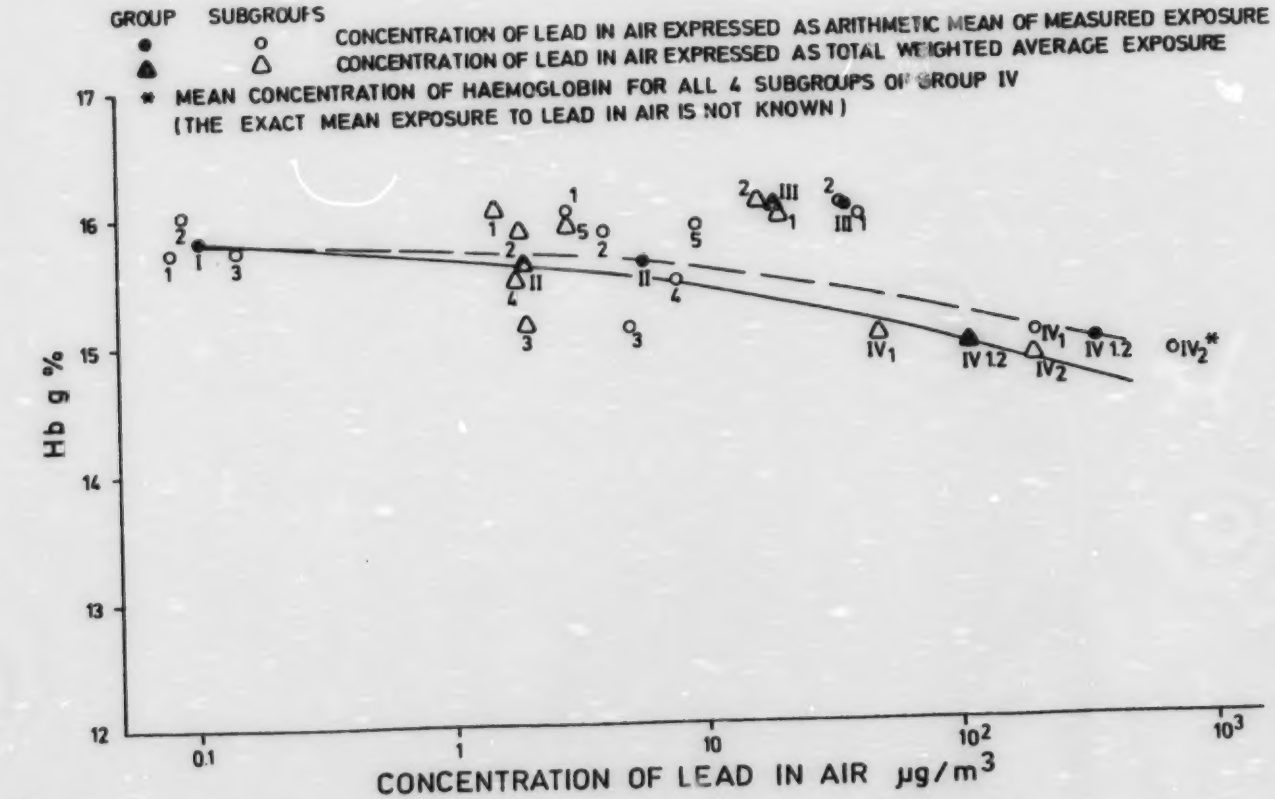

Figure 19. Relationship between lead in air and hemoglobin (Hb).

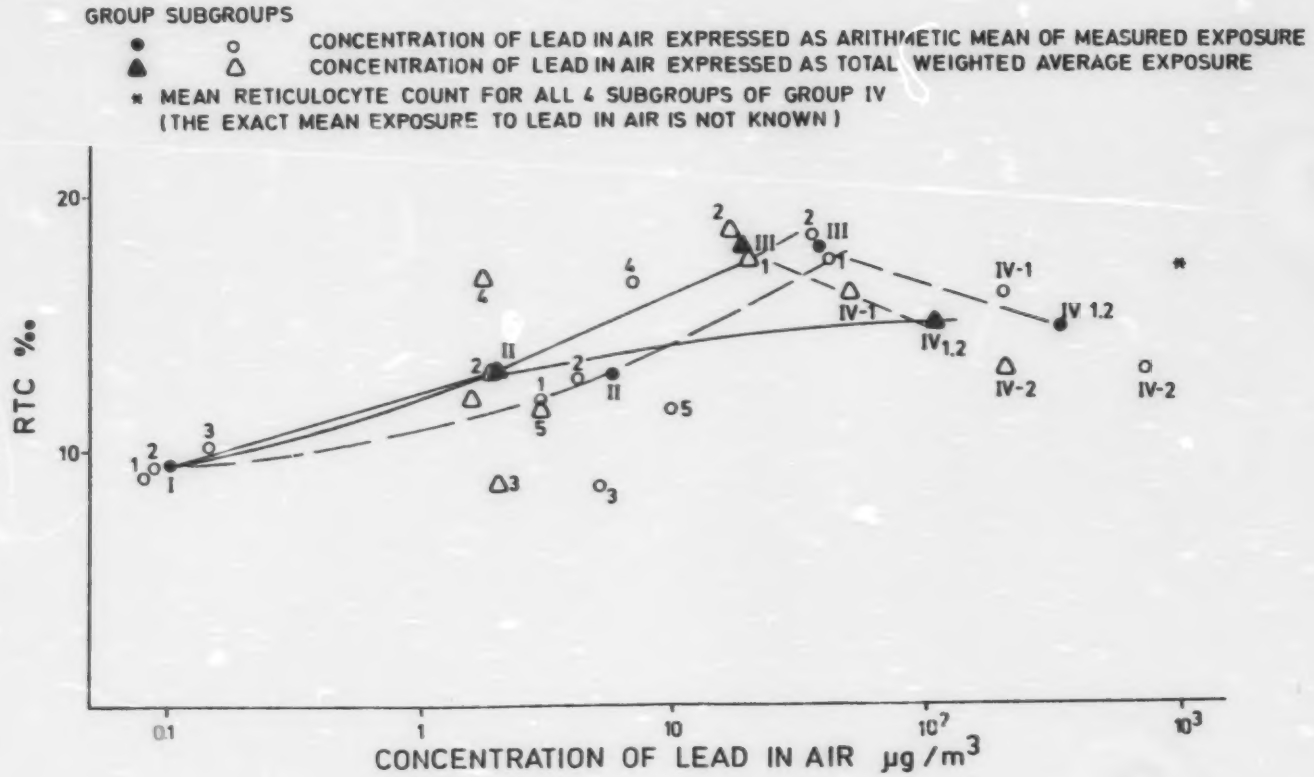

Figure 20. Relationship between lead in air and reticulocytes (Rtc).

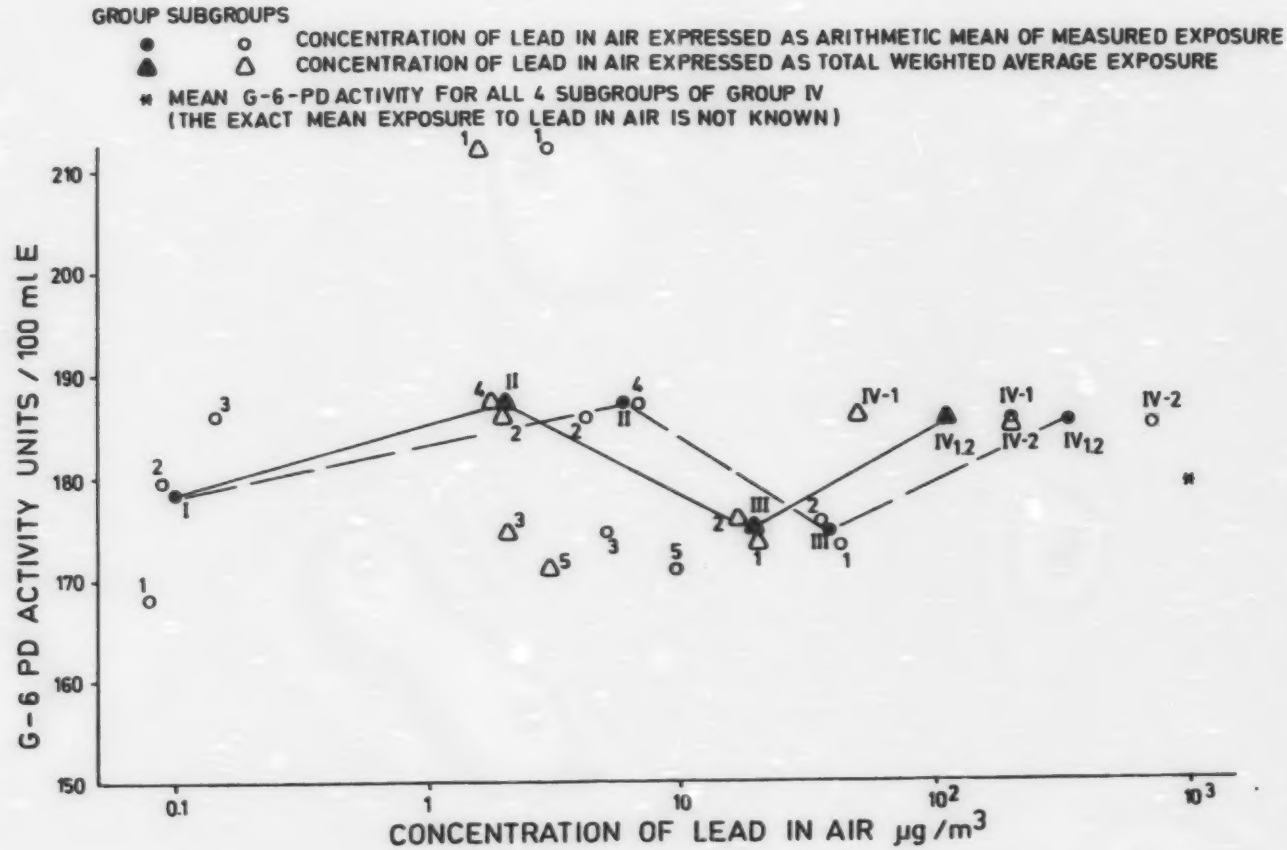

Figure 21. Relationship between lead in air and activity of glucose-6-phosphate dehydrogenase (G-6PD) in red blood cells.

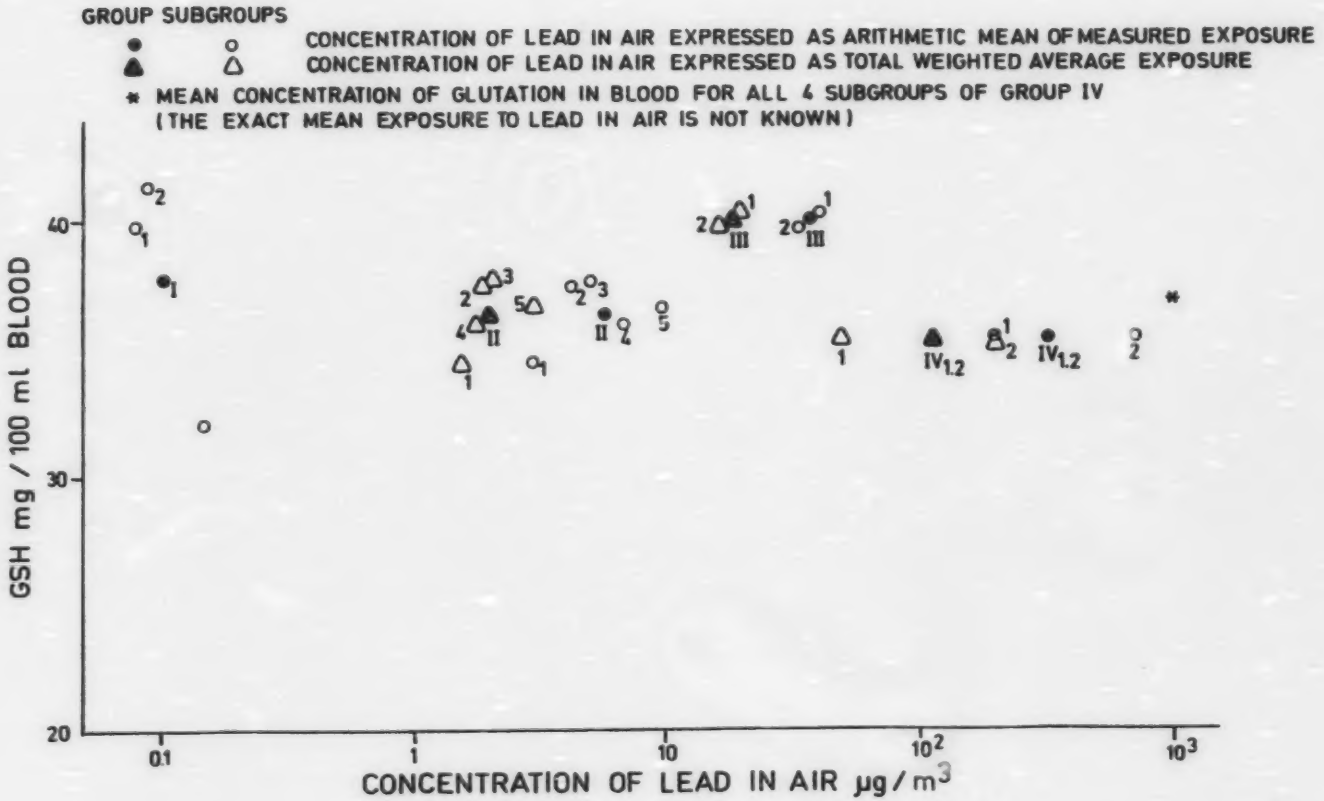

Figure 22. Relationship between lead in air and glutathione (GSH) in blood.

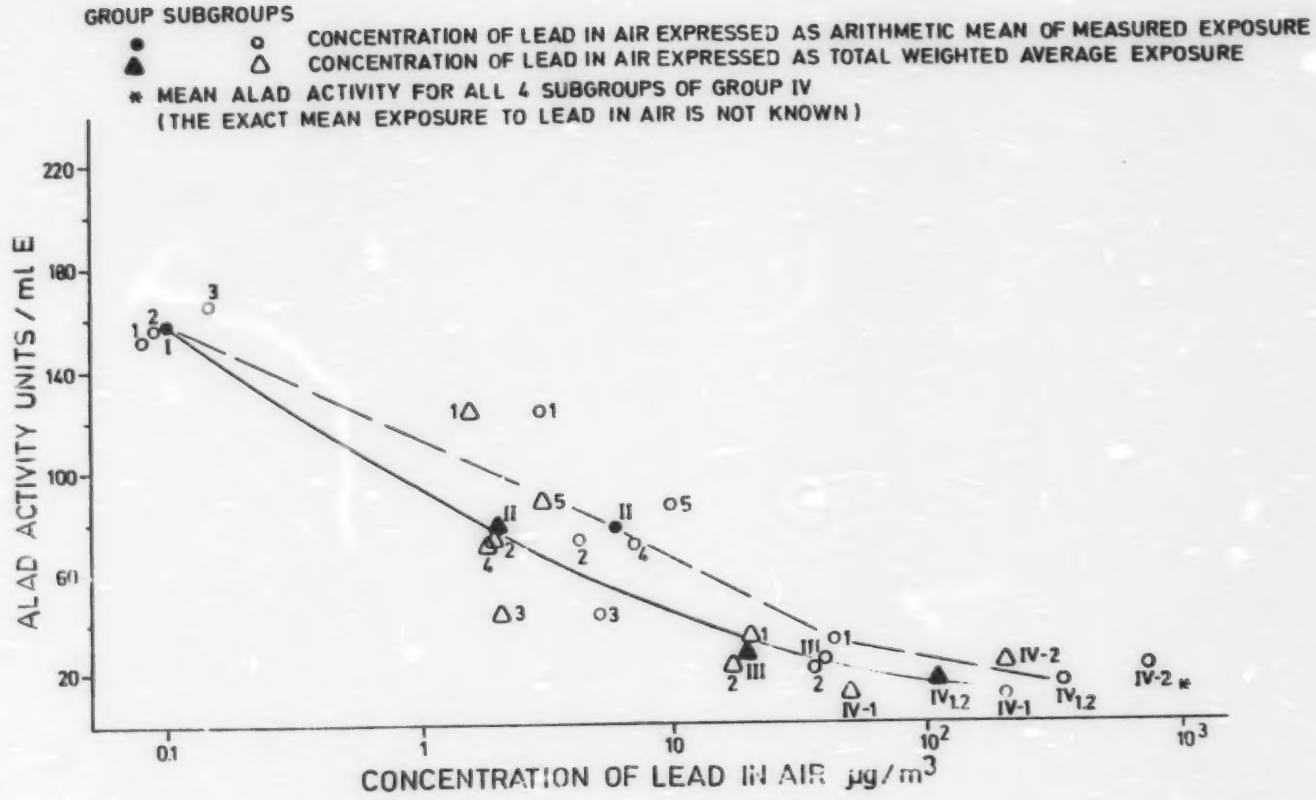

Figure 23. Relationship between lead in air and activity of delta-aminolevulinic acid hydrogenase (ALAD) in red blood cells.

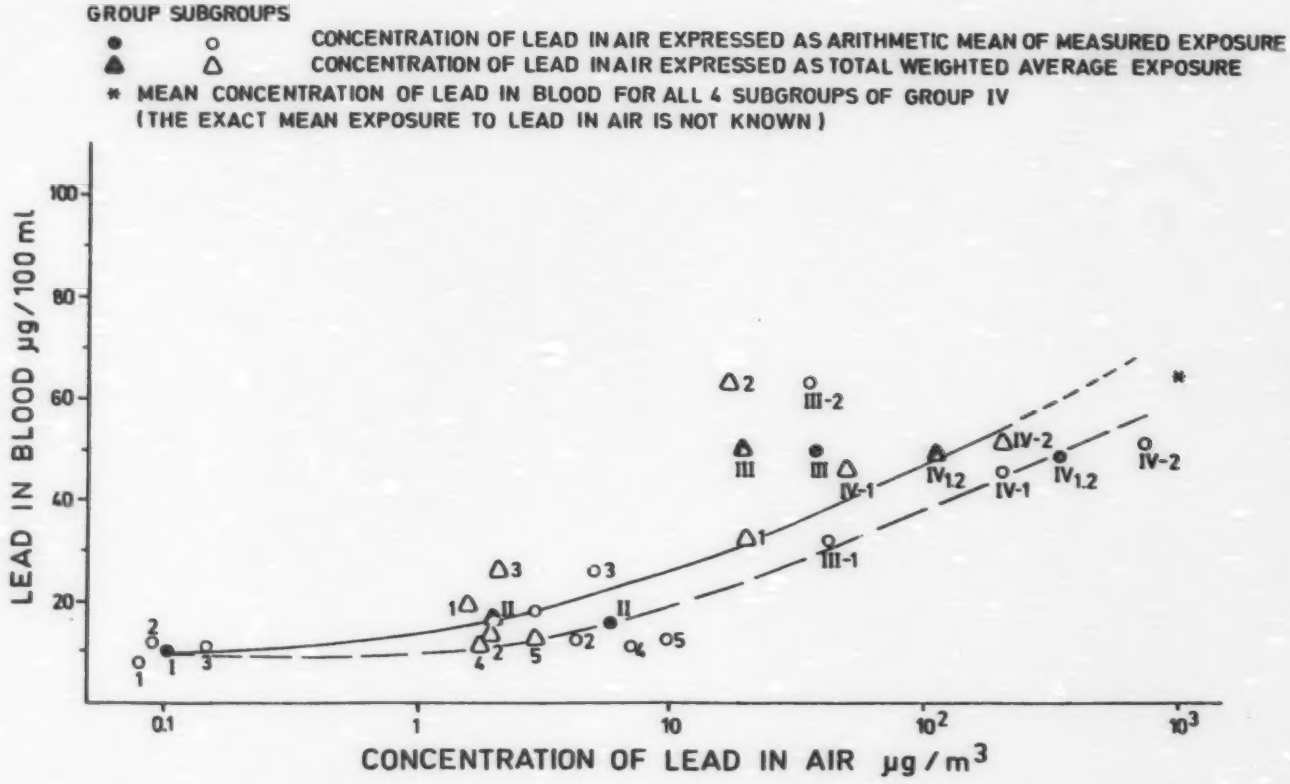

Figure 24. Relationship between lead in air and lead (adjusted values) in blood.

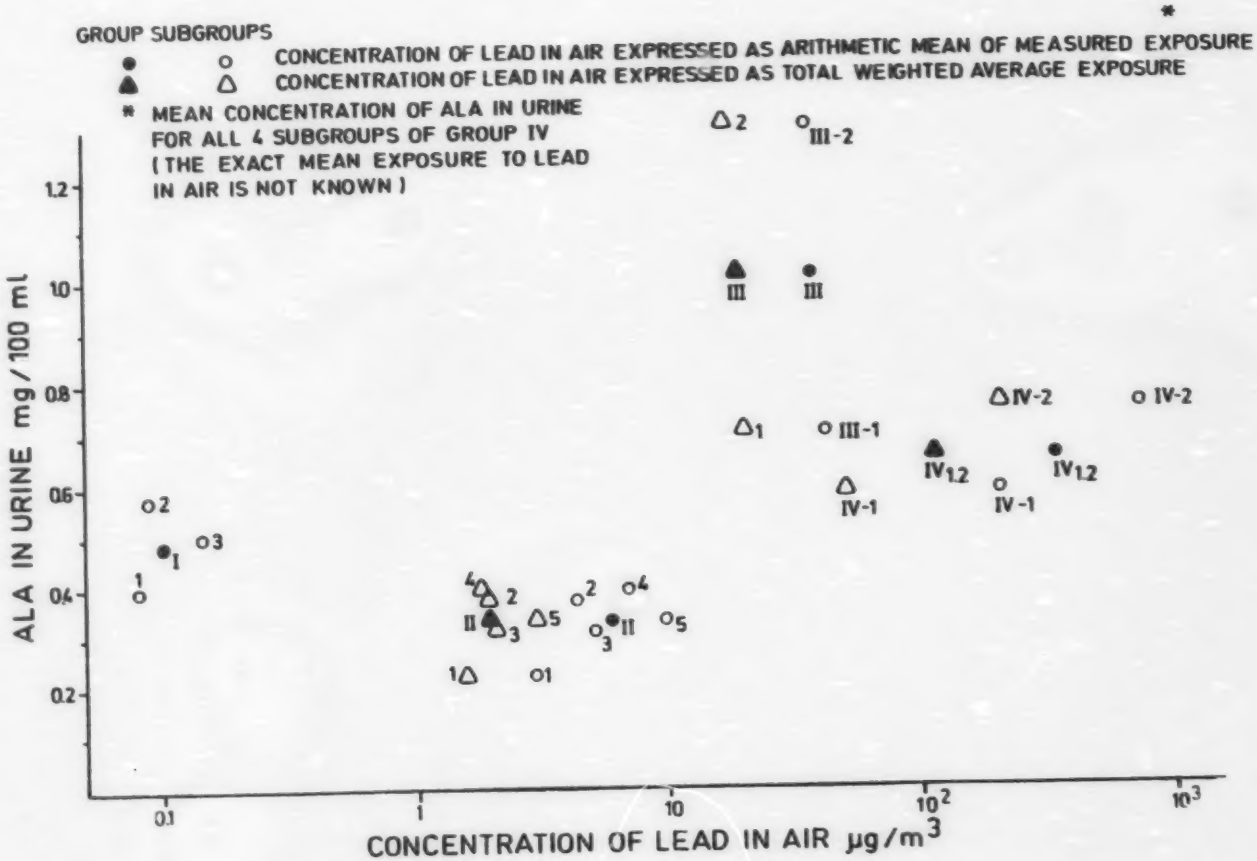

Figure 25. Relationship between lead in air and delta-aminolevulinic acid (ALA) in urine.

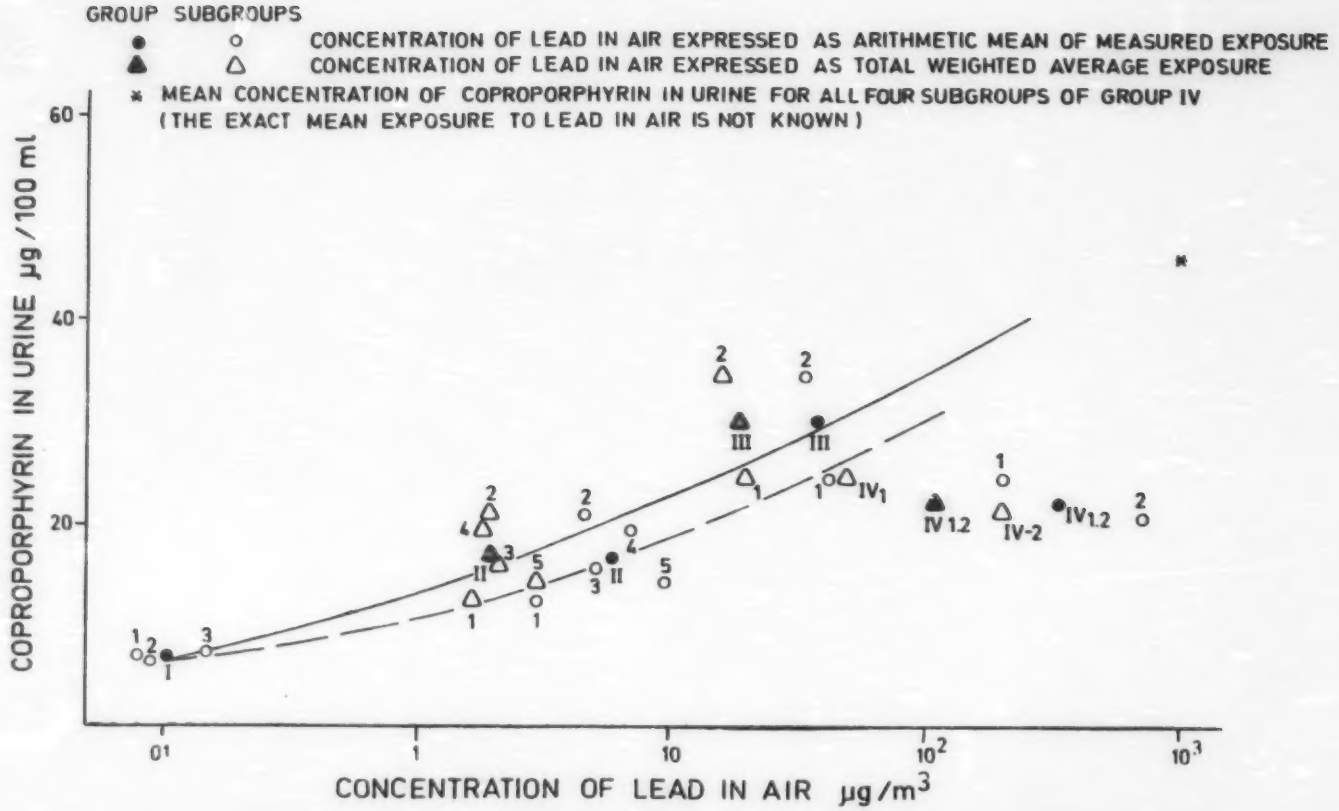

Figure 26. Relationship between lead in air and coproporphyrin in urine.

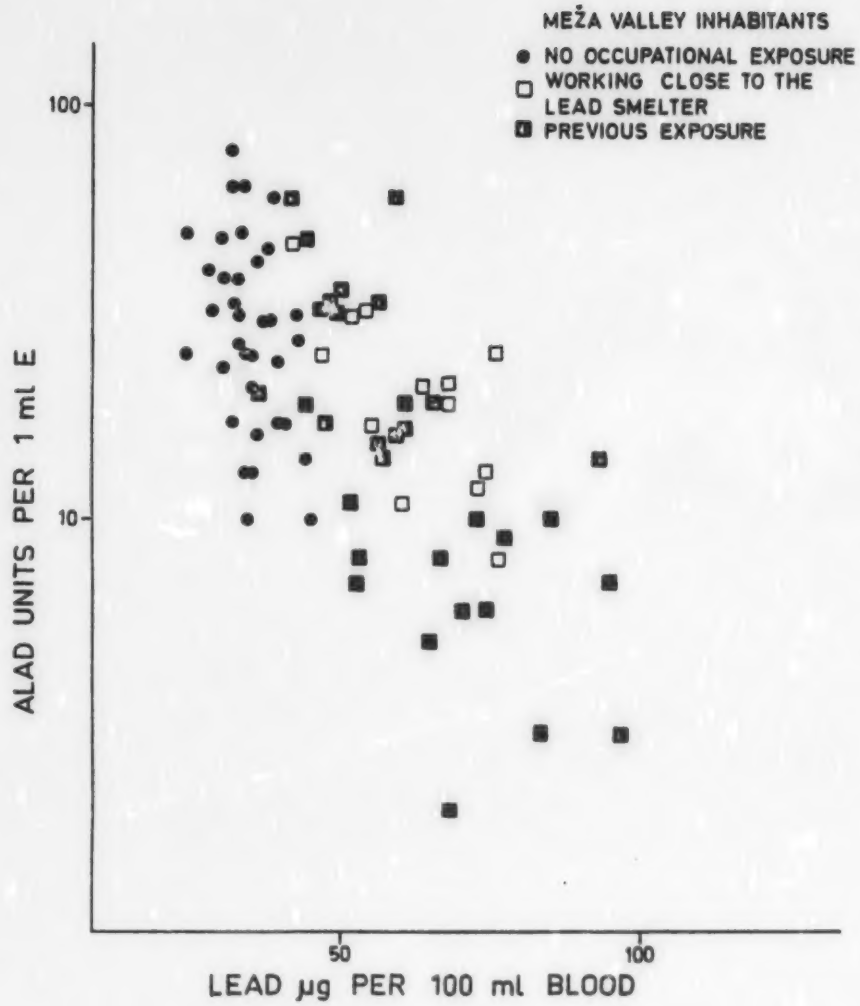

Figure 27. Correlation between lead and ALAD in blood.

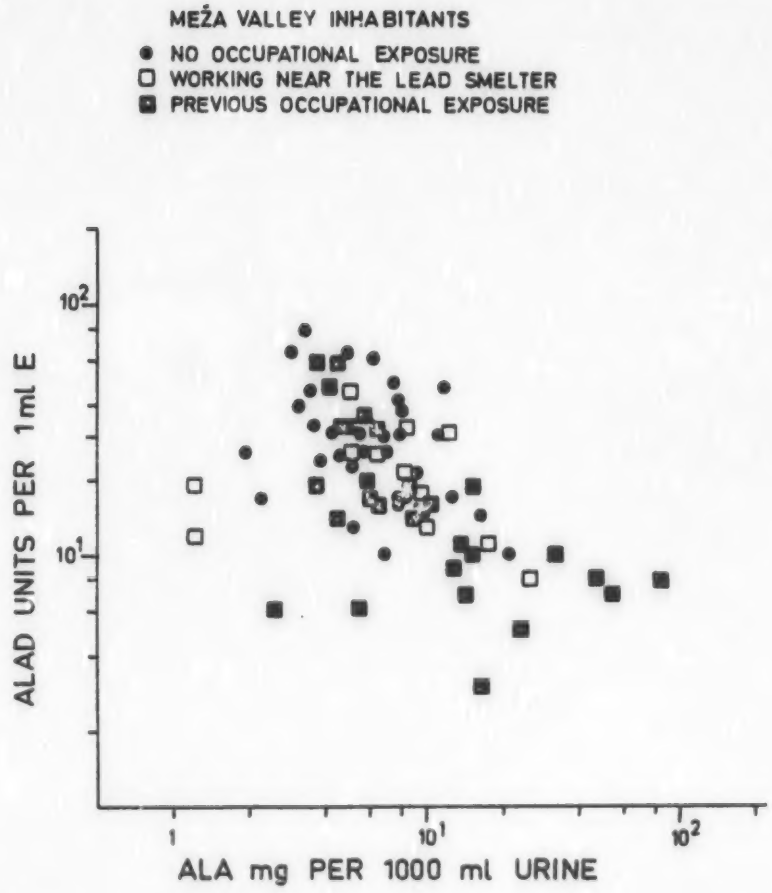

Figure 28. Correlation between ALA in urine and ALAD in blood.

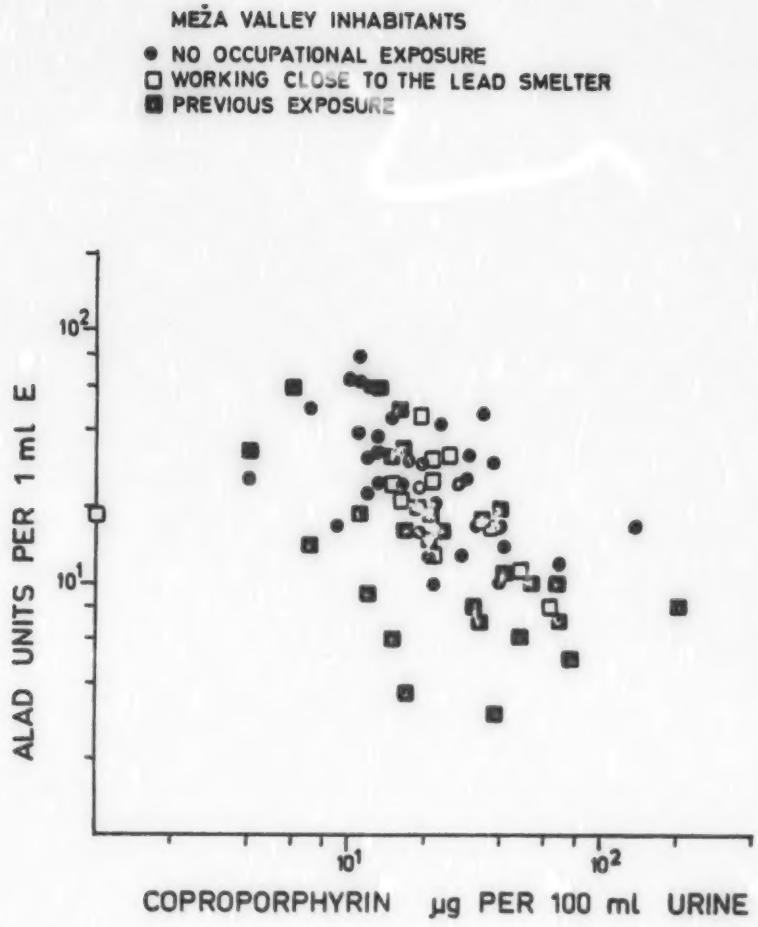

Figure 29. Correlation between coproporphyrin in urine and ALAD in blood.

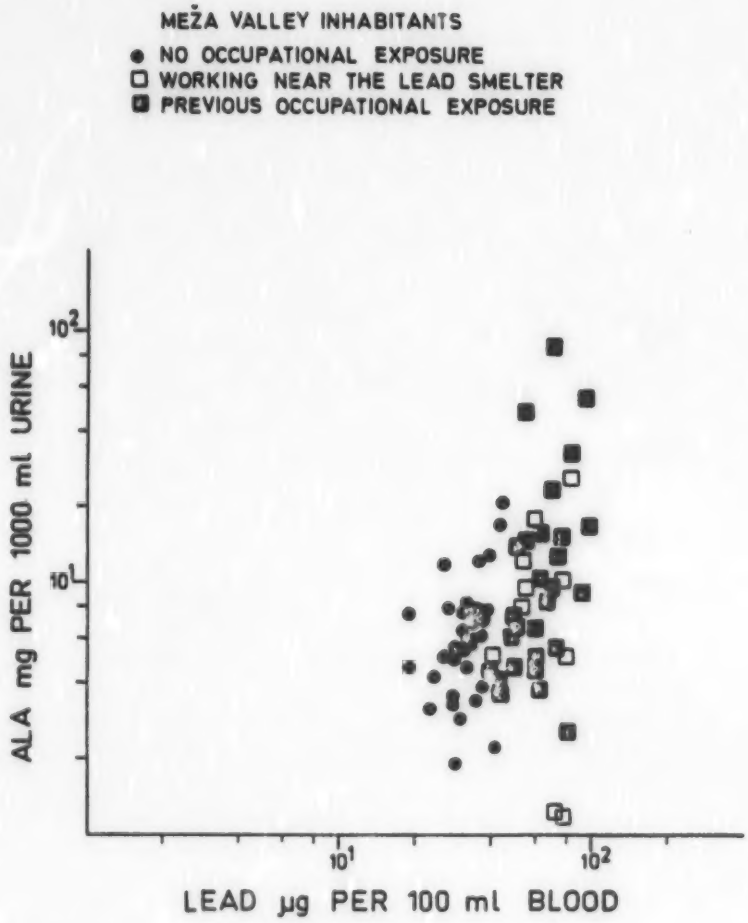

Figure 30. Correlation between lead in blood and ALA in urine.

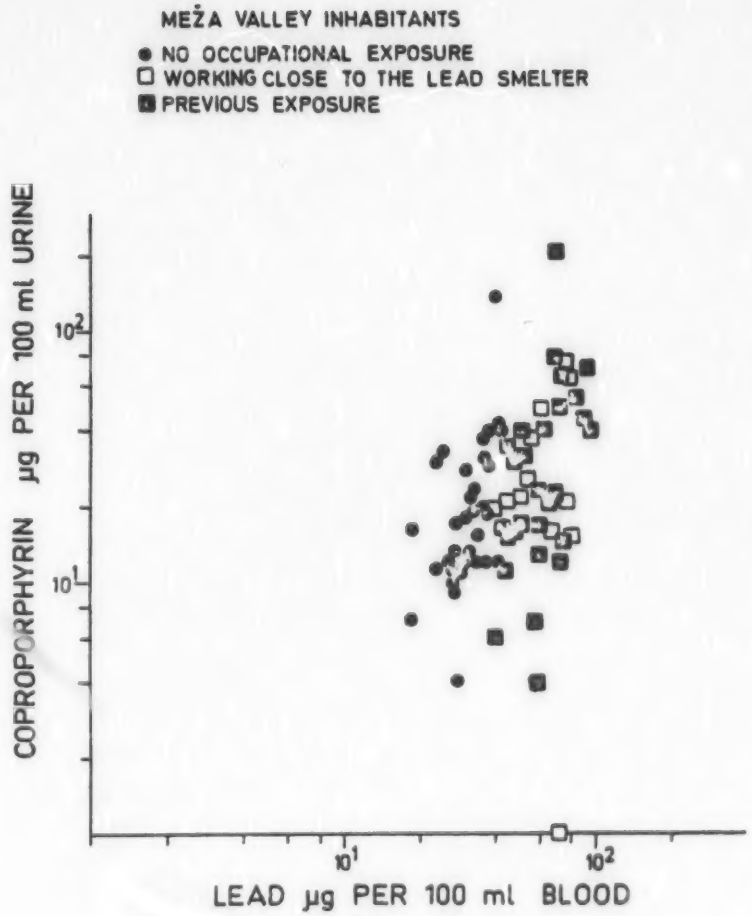

Figure 31. Correlation between lead in blood and coproporphyrin in urine.

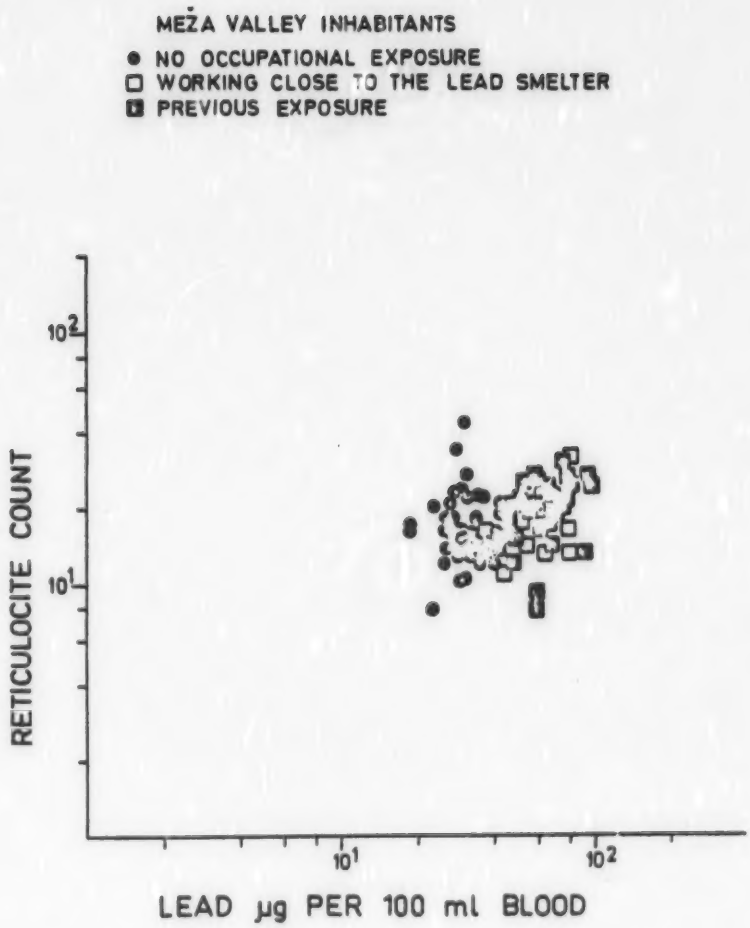

Figure 32. Correlation between lead in blood and reticulocyte count.

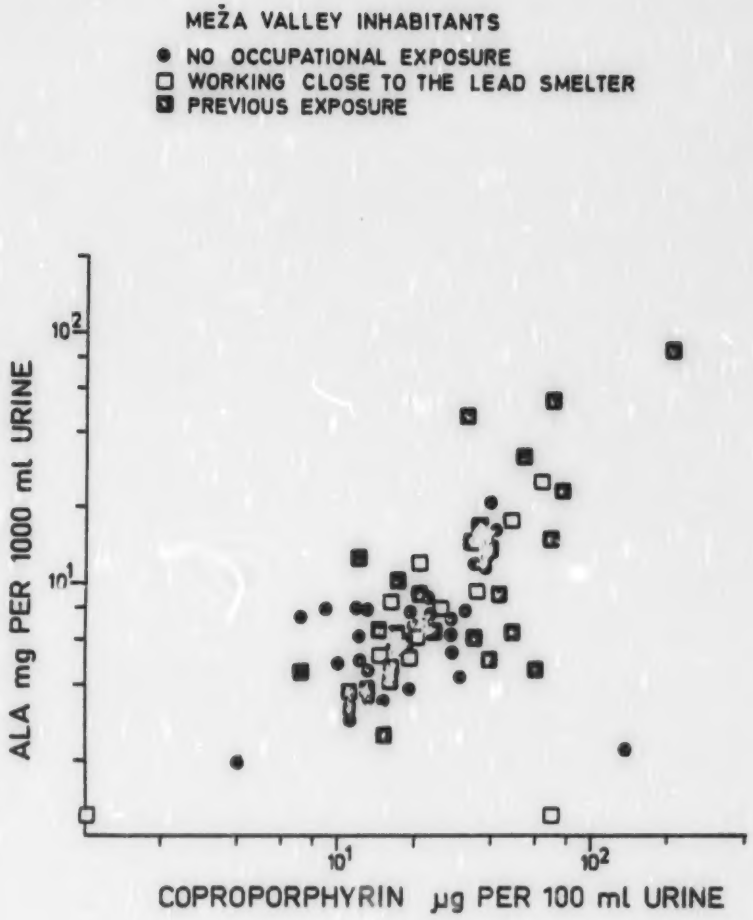

Figure 33. Correlation between coproporphyrin and ALA in urine.

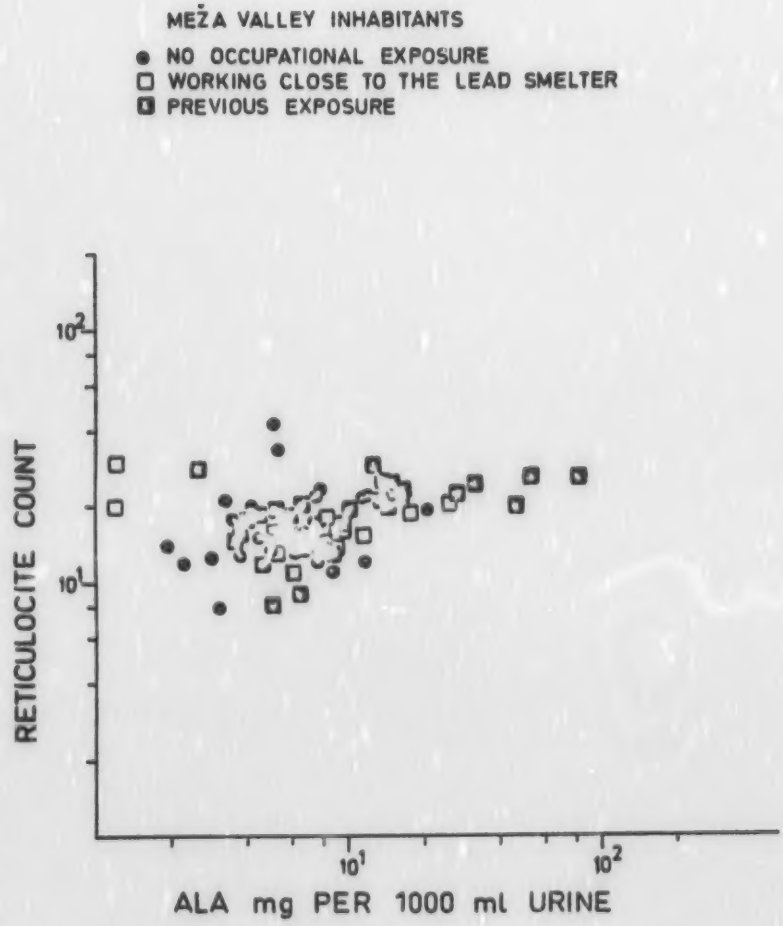

Figure 34. Correlation between ALA in urine and reticulocyte count in blood.

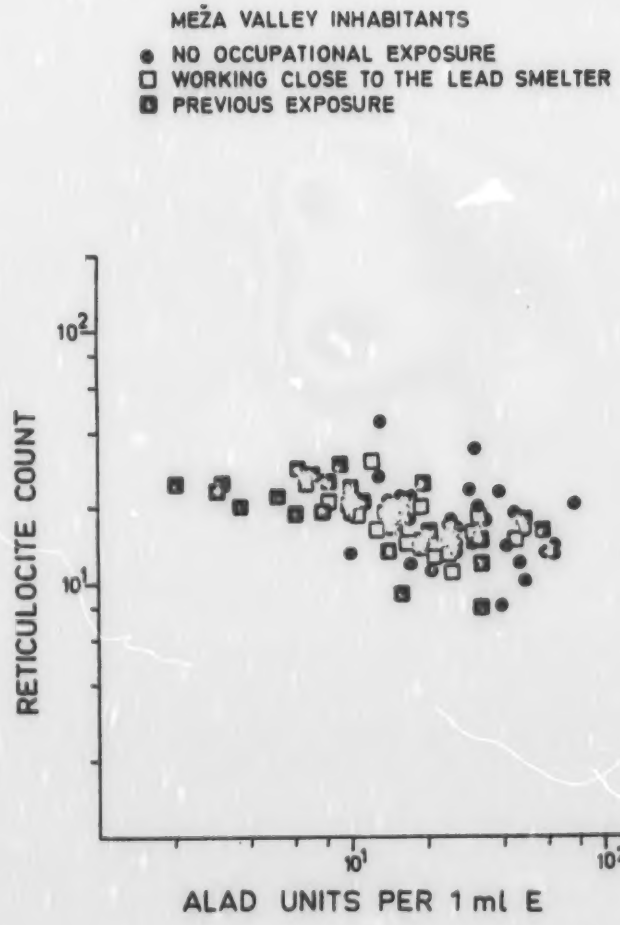

Figure 35. Correlation between ALAD activity and reticulocyte count.

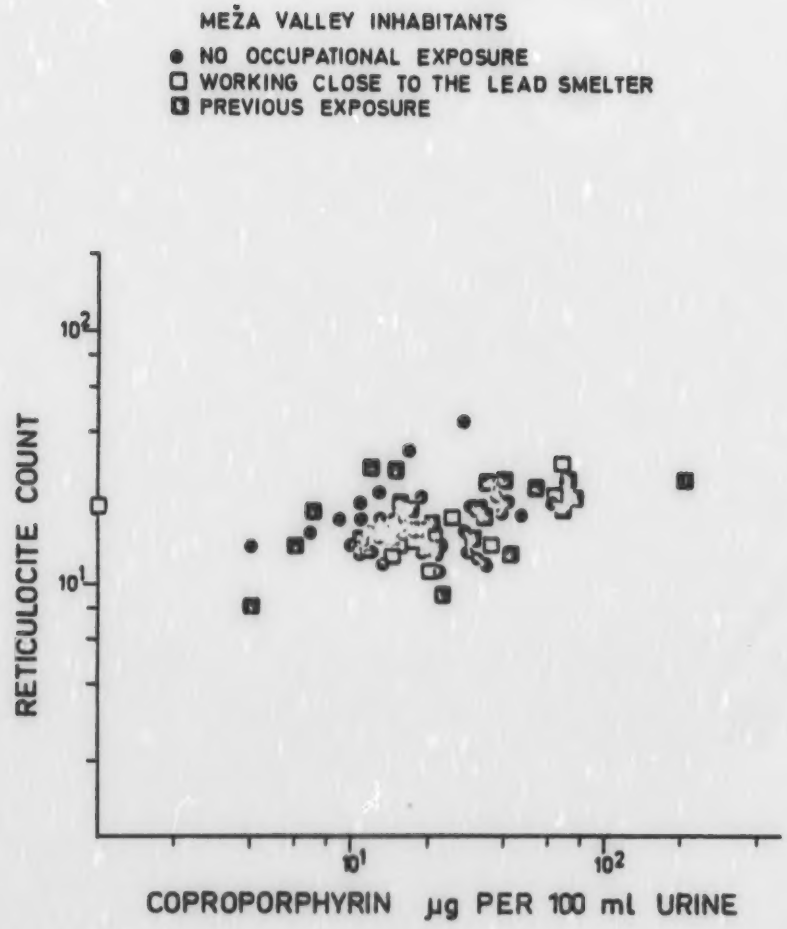

Figure 36. Correlation between coproporphyrin in urine and reticulocyte count.

TABLE 1. METHODS OF SAMPLING AND ANALYSIS BY AREA OR POPULATION SUBGROUP FOR AIR LEAD MEASUREMENTS

A. Outdoors, stationary sampling, total lead

Group	City or area	Major activity or characterization	Method of sampling and analysis	Frequency and duration of sampling
I	1. Bohinjaka Bela	Farming	Low volume samples	Continuous weekly samples during one year
Rural	2. Bovec	Moderate tourism	Ring-oven	June 1972 - July 1973
	3. Tolmin			
II	1. Center (SHP)	Old residential-commercial	High volume samples	Continuous 24-hour sampling Mondays through Fridays during one year
Urban	2. South (INGRA)	New residential-commercial	AAS*	March 1972 - February 1973 (Except for site 1, where sampling period was from September 1972 to August 1973)
Zagreb	3. West (DNZC)	Residential-industrial		
	4. East (Vrbanić)	Residential-industrial		
	5. North (IMI)	Suburban-residential		
III	1. Mezica	4.0 km N	High volume samples	Continuous 24-hour sampling (except 48-hour samples over weekend) for one year
Industrial	2. Zerjav	0.5 km N from the		
Meza Valley	3. Rudarjevo	1.5 km SSW lead	ASS	
	4. Crna SE	2.0 km SSW smeltery		December 1971 - November 1973 as above except changed to weekly samples after 1 July 1973
	5. Crna SW	2.5 km SW		

*Atomic abosrption spectrophotometry

(continued)

TABLE 1. (continued)

B. Indoors, stationary sampling, total lead

Group	City or area	Major activity or characterization	Method of sampling and analysis	Frequency and duration of sampling
II URBAN Zagreb	a. Suburb-residential, first floor (IMI)	3a office close to the moderately busy street 3b office facing the courtyard. Both natural ventilation	Low volume samples, AAS	Three integrated samples from 26 May to 12 July 1972 and eight weekly samples from 12 Dec. 1972 to 6 Feb. 1973
	b. Old center second floor	Office above a very busy street, natural ventilation	Low volume samples, AAS	26 weekly samples, every second week from 3 August 1972 to 1 August 1973
	c. Old center fifth floor	Living room above a busy street, natural ventilation	Low volume samples, AAS	Three integrated samples from 26 May to 12 July 1972 and eight weekly samples from 6 Feb. to 3 April 1973
III Industrial Meza Valley	a. Zerjav	Office 500 m from lead smeltery	Low volume samples, AAS	Continuous weekly samples during a one year period from July 1972 to June 1973
	b. Rudarjevo	Kitchen of an apartment 1.5 km from lead smeltery		
	c. Crna Center	Office 2 km from lead smeltery		(For comparison outdoor weekly samples were also collected at Crna Center)

(continued)

TABLE 1. (continued)

C. Outdoors, stationary sampling, size and weight distribution of lead particles

Group	City or area	Major activity or characterization	Method of sampling and analysis	Frequency and duration of sampling
II Urban	Azgreb, IMI	See characterization A-11-5	Modif. Andersen cascade impactor AAS	Seasonal samples 1971-1973
III Industrial	Meza Valley All sites	See characterization A-III	Modif. Andersen cascade impactor AAS	Seasonal samples 1972-1973

D. Outdoors, personal sampling, total lead

II Urban	Zagreb, streets with busy traffic	"Average citizen"	Casella Personal Samplers AAS	2 integrated, intermittent samples during 3-5 weeks in 1972, May through July
		Streetcar drivers		Two times three shifts at each of: 8 routes, 4 stations, 12 crossings
		Gas station workers		
		Traffic policemen		
Quasi Urban	State frontier stations	Customs officers		5-7 days, 2-5 members of the team at each of 6 frontiers during the working shift

(continued)

TABLE 1. (continued)

E. Indoors, personal sampling, total lead

Group	City or area	Major activity or characterization	Method of sampling and analysis	Frequency and duration of sampling
IV Occupational exposure	1. Kerestinec (TOP)	Lead article manufacture	Personal samplers AAS	Three times the whole working shift at each working place
	2. Zagreb (Munja II)	Lead storage battery plant		
	3. Zagreb (Munja I)	Lead storage battery plant		
	4. Zerjav (Mezice)	Lead smelting plant		

F. Indoors, size-selective sampling

IV Occupational exposure	1. Kerestinec (TOP)	Lead article manufacture	Two stationary samplers side by side, one with a cyclone	Once at each working place
	2. Zerjav (Mezice)	Lead smelting plant		

TABLE 2. SUMMARY OF CONCENTRATIONS OF LEAD IN AIR ($\mu g/m^3$)

A and C Stationary samples outdoors

Group	Area, city or population group	N	Arithmetic mean ± S.D.	M_G	σ_G	95% Results up to	Median	Range	Size-Weight MMD µm	σ_{MMD}
I Rural	1. Bohinjska Bela	50	0.079 ± 0.046			0.150	0.080	0-0.209		
	2. Bovec	50	0.094 ± 0.044			0.170	0.095	0-0.220		
	3. Tolmin	50	0.146 ± 0.067			0.260	0.143	0-0.301		
II Urban Zagreb	1. Center (SHP)	202	0.84 ± 0.64	0.67	1.97	2.08		0.10-4.97		
	2. South (INGRA)	190	0.70 ± 0.54	0.53	2.04	1.75		0.07-3.55		
	3. West (DNZC)	231	0.53 ± 0.50	0.34	2.35	1.40		0.03-4.38		
	4. East (Vrbanić)	225	0.80 ± 0.63	0.61	2.00	1.93		0.11-4.12		
	5. North (IMI)	206	0.99 ± 0.59	0.85	1.76	2.17		0.12-3.43	0.3	6.0
III Industrial Meza Valley	1. Mezice	350	22.7 ± 24.4	18.2	2.12	63		0.1-236	2.1	1.9
	2. Zerjav	348	28.2 ± 23.0	23.0	1.95	70		0.3-217		
	3. Rudarjevo	336	36.9 ± 47.0	21.0	2.86	118		0.5-328		
	4. Crna SE	340	29.3 ± 36.1	13.0	3.40	100		0.1-259		
	5. Crna W	343	26.5 ± 35.5	18.0	2.72	100		0.1-222		

(continued)

TABLE 2. (continued)

B Stationary samples indoors, total lead

Group	Area, city or population group	N	Arithmetic mean ± S.D.	M_G	σ_G	95% Results up to	Range	In/Out Ratio $\bar{X}$	In/Out Ratio Range
II	a. suburb office	8	1.83				1.36-2.04	0.52	0.47-0.61
Urban	b. center office	26	2.30				0.90-4.40	1.09	0.60-1.76
Zagreb	c. center apt.	8	0.62				0.34-1.21	0.68	0.59-0.78
III	a. Zerjav	52	12.9 ± 4.9	12.3	1.3	21	4.0-32.1	0.46	0.33-0.77
Industrial	b. Rudarjevo	52	14.5 ± 9.6	9.6	2.6	48	2.3-37.9	0.40	0.23-0.86
Meza Valley	c. Crna C	51	16.6 ± 12.7	11.0	2.4	47	1.4-60.9	0.60	0.19-1.69

(continued)

TABLE 2. (continued)

D Personal samples outdoors, total lead

Group	Area, city or population group	N	Arithmetic mean ± S.D.	M_G	σ_G	95% Results up to	Range	Respirable % $\bar{X}$	Respirable % Range
II	"Average citizen"	2	6.3				5.7 - 6.8		
Urban	Streetcar drivers	121	5.1 ± 5.24	3.9	1.64	8.8	1.34-41.0		
	Gas stations empl.	79	4.3 ± 2.70	4.0	1.65	9.2	1.10-19.1		
	Traffic policemen	69	9.9 ± 5.91	8.2	1.74	20.0	2.84-36.5		
Quasi Urban	Customs officers	133	7.0 ± 3.81	6.2	1.64	14.0	0.44-25.9		

E and F Personal samples indoors, total lead and size selective samples

IV	Lead article manufacturing	33	225 ± 189	213	2.62	1006	46- 848	65.4	19.1-98.4
Occupat.	Lead storage battery II	39	680 ± 730	350	3.50	2500	41- 3589		
exposed	Lead storage battery I	33	4722 ± 6119	2160	3.24	16000	264-25822		
	Lead smelters	81	4810 ± 5220	2300	3.65	20000	140-43120	27.1	9.0-55.6

TABLE 3. INDOOR-OUTDOOR RELATIONSHIP OF CONCENTRATION OF LEAD IN AIR ($\mu g/m^3$)

Period	Home (II-2-c)					
	Indoors	Outdoors	In Out ratio	Indoors	Outdoors	In Out ratio
26 May-13 June	0.50	0.84	0.60	1.14		
13-25 June	0.53	0.77	0.69	1.19	0.44	2.70
26 June-12 July	0.57	0.85	0.67	1.03	0.37	2.78
Arithmetic mean	0.53	0.82	0.65			2.74

TABLE 4. INDOOR-OUTDOOR RELATIONSHIP OF CONCENTRATION OF LEAD IN AIR ($\mu g/m^3$)

Zagreb-IMI 1972/73

Period	Street			Courtyard		
	Indoors	Outdoors	In-Out ratio	Indoors	Outdoors	In-Out ratio
12-19 Dec.	1.36	2.23	0.61	0.65	0.38	1.71
19-26 Dec.	1.57	3.08	0.51	0.95	0.46	2.07
26 Dec-3 Jan.	1.94	4.02	0.48	1.59	0.79	2.01
3-9 Jan.	2.04	4.05	0.50	1.33	1.01	1.32
9-16 Jan.	1.93	3.31	0.58	1.45	1.18	1.23
16-23 Jan.	2.03	3.38	0.60	1.97	1.12	1.76
23-30 Jan.	1.85	3.89	0.48	1.56	1.17	1.33
30 Jan.-6 Feb.	1.91	4.09	0.47	2.67	1.16	2.30
Arithmetic mean	1.83	3.51	0.52	1.52	0.91	1.67
Range	1.36--2.04	2.23--4.09	0.47--0.61	0.65--2.67	0.38--1.18	1.23--2.30

TABLE 5. INDOOR-OUTDOOR RELATIONSHIP OF CONCENTRATIONS OF LEAD IN AIR*

Zagreb-IMI 1972/73

Period	Street		Courtyard	
	Outdoor	Indoor	Indoor	Outdoor
12-19 Dec.	1	0.61	0.29	0.17
19-26 Dec.	1	0.51	0.31	0.15
26 Dec.-3 Jan.	1	0.48	0.40	0.20
3-9 Jan.	1	0.50	0.33	0.25
9-16 Jan.	1	0.58	0.44	0.36
16-23 Jan.	1	0.60	0.58	0.33
23-30 Jan.	1	0.48	0.40	0.30
30 Jan.-6 Feb.	1	0.47	0.65	0.28
Arithmetic mean	1	0.52	0.43	0.26
Range		0.47--0.61	0.29--0.61	0.15--0.36

* Expressed in relation to the street outdoor concentration as unity.

TABLE 6. INDOOR-OUTDOOR REPATIONSHIP OF CONCENTRATION OF LEAD IN AIR ($\mu g/m^3$)

Zagreb II-2-c 1973

Period	Indoors	Outdoors	In-Out
6-13 Feb.	1.21	1.60	0.76
13-20 Feb.	0.65	0.88	0.74
20-27 Feb.	0.62	0.98	0.63
27 Feb.-6 March	0.64	1.02	0.63
6-13 March	0.34	0.47	0.72
13-20 March	0.39	0.62	0.63
20-27 March	0.71	0.91	0.78
27 March-3 Apr.	0.41	0.70	0.59
Arithmetic mean	0.62	0.90	0.68
Range	0.34-1.21	0.47-1.60	0.59-0.78

TABLE 7. INDOOR-OUTDOOR RELATIONSHIP OF CONCENTRATION OF LEAD IN AIR ($\mu g/m^3$)

Zagreb II-2-b 1972/73

Period	Indoors	Outdoors	In-Out ratio
3-7 August	1.7	1.7	1.00
14-21 August	1.4	1.5	0.93
28 Aug.-4 Sept.	2.6	2.4	1.08
11-18 Sept.	3.6	3.1	1.16
26 Sept.-3 Oct.	3.4	2.3	1.48
10-17 Oct.	3.7	2.2	1.68
24-31 Oct.	4.4	2.5	1.76
14-21 Nov.	2.8	1.7	1.65
27 Nov.-5 Dec.	2.7	2.8	0.96
12-19 Dec.	1.4	1.0	1.40
29 Dec.-3 Jan.	2.2	2.4	0.92
9-16 Jan.	2.1	2.7	0.78
23-30 Jan.	2.3	2.5	0.92
30 Jan.-6 Feb.	3.7	3.5	1.06
13-20 Feb.	2.8	2.1	1.33
27 Feb.-6 March	2.2	2.2	1.00
13-20 March	2.1	2.3	0.91
27 Mar.-3 Apr.	1.8	2.6	0.69
10-17 April	2.3	1.8	1.28
24 Apr.-8 May	0.9	1.5	0.60
15-22 May	1.6	1.5	1.07
29 May-5 June	1.8	1.9	0.95
12-19 June	1.5	1.6	0.94
26 June-3 July	1.3	1.8	0.72
10-17 July	1.6	1.6	1.00
24 July-1 Aug.	1.5	1.5	1.00
Σ	59.4	54.7	28.27
Arithmetic mean	2.3	2.1	1.09
Range	0.9-4.4	1-3.5	0.60-1.76

TABLE 8. SUMMARY OF DATA FOR LEAD IN AIR ($\mu g/m^3$)

Meza Valley - June 1972 - May 1973

Monthly Arithmetic Means Based on Weekly Averages									
Site	Zerjav			Rudarjevo			Crna C		
Month	Indoor	Outdoor	In/out	Indoor	Outdoor	In/out	Indoor	Outdoor	In/out
June	11.9	21.4	7.4	7.4	18.1	0.41	7.1	13.4	0.53
July	9.8	16.5	0.59	9.2	16.6	0.55	8.4	13.3	0.63
August	10.1	17.6	0.57	5.0	9.7	0.52	4.8	7.7	0.62
September	10.0	18.0	0.56	9.0	22.6	0.40	10.3	16.6	0.62
October	12.0	30.2	0.40	15.8	35.7	0.44	14.9	24.4	0.61
November	14.6	33.9	0.43	29.7	73.3	0.41	40.2	53.9	0.75
December	19.2	44.9	0.43	26.6	70.3	0.38	26.6	58.8	0.45
January	9.6	21.5	0.45	21.0	60.3	0.35	27.2	46.6	0.58
February	17.2	40.4	0.43	24.0	49.5	0.48	31.1	54.1	0.57
March	16.2	35.0	0.46	13.6	34.9	0.39	14.0	24.7	0.57
April	13.0	30.4	0.43	6.9	17.3	0.40	10.1	12.7	0.80
May	11.8	29.1	0.41	6.8	20.7	0.33	8.9	13.5	0.66
Yearly average	12.8	28.1	0.46	14.5	36.5	0.40	16.6	27.6	0.60
Highest weekly average	32.1	69.5		37.9	89.3		60.9	76.7	
Highest 24-hour average at the same site		198.9			285.7				

TABLE 9. RELATIVE CUMULATIVE MASS DISTRIBUTION OF LEAD PARTICLES BY SIZE*

Zagreb 1971-1973

Sampling Medium: Al-Foils						
Period Separation stage	6 Sept. -13 Oct. 1971	26 Jan. -1 Feb. 1972	22 May -22 July 1972	30 Aug. -22 Sept. 1972	29 Jan -26 Feb. 1973	Total average %
1	7.5	6.8	5.7	8.0	9.2	7.5
2	11.8	10.3	9.2	12.0	14.0	11.5
3	16.9	14.8	14.0	16.9	18.9	16.3
4	23.5	23.3	20.7	23.4	26.1	23.4
5	30.0	31.3	31.0	29.1	33.7	31.2
6	100.0	100.0	100.0	100.0	100.0	100.0
Mass median µm diameter	0.27	0.29	0.32	0.26	0.31	0.28
σ_G	5.7	5.0	4.5	6.3	6.0	5.5
95% Mass up to µm	4.8	4.2	4.0	5.4	5.9	4.8

* Using a Modified Anderson Cascade Impactor.

TABLE 10. RELATIVE CUMULATIVE MASS DISTRIBUTION OF LEAD PARTICLES BY SIZE*

Meza Valley 1972-1973

Sampling Medium: Al-foils			
Period Separation stage	21-31 March 1972	5-9 June 1972	9-17 March 1973
1	17.3	11.0	24.4
2	35.7	26.7	44.3
3	63.5	51.3	69.5
4	89.5	79.0	90.3
5	96.3	88.1	94.7
6	100.0	100.0	100.0
Mass median diameter μm	2.0	1.6	2.1
σ_G	1.7	1.9	2.1
95% Mass up to μm	5.2	4.6	6.2

* Using a Modified Andersen Cascade Impactor.

TABLE 11. EFFECT OF PARTICLE ORIGIN ON MASS MEDIAN DIAMETER

Winter 1973

Area	Kind of particles	MMD µm	σ_G	95% particles up to µm
Urban	Total	1.2	7.7	35.0
	Lead	0.3	6.0	6.5
Industrial	Total	1.3	2.6	5.9
	Lead	2.1	1.5	6.2

TABLE 12. CALCULATION OF THE WEIGHTED-AVERAGE WEEKLY EXPOSURE OF A CITIZEN

Location or activity	Average conc. of Pb $\mu g/m^3$	Hours per week	Conc. x time
Working hours	1.2	42	50.4
Outdoor activities	6.3	14	88.2
Recreation	0.2	6	1.2
At home:			
rest of the working days	0.7	22	15.4
night	0.3	48	14.4
weekends	0.5	36	18.0
Total		168	187.6
Weighted-average weekly exposure:		1.1 $\mu g/m^3$	

TABLE 13. CALCULATION OF WEIGHTED-AVERAGE WEEKLY EXPOSURE TO LEAD

Population subgroup	Concentration x time ($\mu g\ Pb/m^3$) x (hours/week) occupational	nonoccupational outdoor	nonoccupational indoor	Total conc. x time	Weighted average weekly exposure
Postmen	3.0x42	6.3 x14	0.5 x112	270.2	1.6
Gas station employees	4.3x42	6.3 x14	0.5 x112	324.8	1.9
Streetcar drivers	5.1x42	6.3 x14	0.5 x112	358.4	2.1
Customs officers	7.0x42	0.15x28	0.08x 98	306.0	1.6
Traffic policemen	9.9x35	6.3 x14	0.5 x124	496.7	3.0

TABLE 14. CONCENTRATIONS OF LEAD IN AIR ($\mu g/m^3$)

Meza Valley, 1 December 1971 - 30 April 1972

Area	N	Arithmetic Mean ± SD	M_G	σ_G	95% Results up to	Range	% Indoors
Mezice	141	29.0 ± 32.2	24.0	2.08	80	0.4-236	
Zerjav	139	35.5 ± 29.9	28.5	1.96	87	1.2-217	44
Rudarjevo	129	54.5 ± 63.4	32.5	2.92	193	1.4-328	40
Crna SE	133	43.6 ± 48.0	20.6	3.88	195	0.3-259	
Crna W	141	41.0 ± 48.4	27.2	2.79	152	0.3-222	59

TABLE 15. CALCULATION OF WEIGHTED-AVERAGE WEEKLY EXPOSURE TO LEAD

People living in	Concentration x time ($\mu g\ Pb/m^3$)x(hours/week) occupational	nonoccupational outdoor	nonoccupational indoor	Total conc. x time	Weighted average weekly exposure
Mezice	29x0.59x42	29x14	29x0.42x98	2318.26	14
Zerjav	36x0.59x42	36x14	36x0.42x98	2877.84	17
Rudarjevo	55x0.59x42	55x14	55x0.42x98	4396.70	26
Crna SE	46x0.59x42	46x14	46x0.42x98	3677.24	22
Crna W	41x0.59x42	41x14	41x0.42x98	3277.54	20

TABLE 16. ESTIMATED AVERAGE EXPOSURE TO AIRBORNE LEAD

Group	Subgroup or Location	Number of subjects	Estimated mean exposure to lead in air µg/m³ $\bar{x}$	M_G	Total* weighted average	Source of exposure estimate
I Rural area	1. Bohinjska Bela	49	0.08	0.08		Annual average of one sampling site per location
	2. Bovec	47	0.09	0.10		
	3. Tolmin	45	0.15	0.14		
	I 1-3	141	0.11	0.10		†
II Urban area	1. Postmen	44	(3.0)	(2.5)	(1.6)	Average of measured exposure during working shifts for each subgroup
	2. Gas station employees	22	4.3	4.0	1.9	
	3. Streetcar drivers	43	5.1	3.9	2.1	
	4. Customs officers	75	7.0	6.2	1.8	
	5. Traffic policemen	27	9.9	8.0	3.0	
	II 1-5	211	5.9	5.0	2.0	†

* Total weighted average exposure calculated from mean exposures at working place, at home and during outdoor activities, weighted by the time spent at each place per week.

† Group exposures calculated from subgroup exposures weighted by the number of subjects in each subgroup.

(continued)

TABLE 16. (continued)

Group	Subgroup or location	Number of subjects	Estimated mean exposure to lead in air µg/m³ $\bar{x}$	M_G	Total weighted average	Source of exposure estimate
II Lead Smeltery area	1. No occupational exposure	32	42	26	20	Average of the mean 5 month concentrations at the 5 sampling sites weighted by the number of subjects living around each site
	2. Working close to the smeltery or previous occupational exposure	42	36	25	17	
	III 1,2	74	38	25	19	†
IV Occupationally Exposed	1. Lead article manufacture, TOP	47	209	150	50	Average of exposures of all subjects in each subgroup (personal exposures or, if missing, mean exposure at the working place)
	2. Lead storage battery plant, Munja II	33	735	450	209	
	3. Lead storage battery plant, Munja I	(47)	workers wearing respirators			
	4. Lead smeltery plant Mezice	(51)	measured exposure not reliable			
	IV 1,2	80	338	274	116	†

† Group exposures calculated from subgroup exposures weighted by the number of subjects in each subgroup.

TABLE 17. CORRELATION AND REGRESSION BETWEEN DUPLICATE BLOOD LEAD DETERMINATIONS FOR INDIVIDUAL DAYS

Group	Subgroup or location	Date	Number of duplicate samples	Correlation coefficient r	Regression equation constant b	and sb
I Rural area	1. Bohinjska Bela	10. 7.1972	17	0.98	1.07	0.03
		11. 7.1972	16	0.88	0.92	0.06
		12. 7.1972	16	0.89	0.85	0.06
	2. Bovec	5. 7.1972	18	0.96	0.12	0.04
		6. 7.1972	15	0.91	1.03	0.06
		7. 7.1972	14	0.94	1.10	0.04
	3. Tolmin	28. 6.1972	16	0.90	0.94	0.03
		29. 6.1972	13	0.95	0.94	0.04
		30. 6.1972	16	0.84	0.95	0.04
II Urban area	1. Postmen and other post office workers	16. 4.1973	10	0.93	0.95	0.05
		17. 4.1973	10	0.96	1.01	0.05
		18. 4.1973	6	0.97	1.07	0.05
		19. 4.1973	11	0.98	0.95	0.03
		20. 4.1973	7	0.97	0.99	0.07
	2. Gas station employees	3. 6.1971	3	0.99	1.08	0.08
		24. 6.1971	4	0.94	0.97	0.06
		29. 6.1971	8	0.98	1.08	0.04
		1. 7.1971	7	0.92	0.85	0.12
	3. Streetcar drivers	28.10.1970	8	0.97	0.82	0.03
		29.10.1970	10	0.93	0.87	0.03
		30.10.1970	8	0.93	0.84	0.06
		2.11.1970	10	0.85	0.88	0.05
		3.11.1970	7	0.70	1.08	0.13
	4. Customs officers	7. 7.1971	7	0.94	0.91	0.08
		8. 7.1971	9	0.98	1.10	0.02
		9. 7.1971	10	0.80	1.19	0.13
		12. 7.1971	5	0.45	0.95	0.124
		13. 7.1971	7	0.92	1.19	0.04
		14. 7.1971	5	0.91	0.95	0.04
		15. 7.1971	3	0.96	1.02	0.10
		16. 7.1971	9	0.47	1.10	0.04
		18. 7.1971	7	0.73	1.07	0.06
		19. 7.1971	10	0.94	1.09	0.04
		20. 7.1971	3	0.71	0.99	0.09

(continued)

TABLE 17. (continued)

Group	Subgroup or location	Date	Number of duplicate samples	Correlation coefficient r	Regression equation constant b and sb	
II Urban area	5. Traffic policemen	27.10.1971	11	0.98	1.01	0.03
		28.10.1971	5	0.98	0.99	0.03
		16. 6.1971	4	0.99	0.94	0.03
		17. 6.1971	3	0.48	1.07	0.25
		23. 6.1971	4	0.95	1.04	0.05
III Lead Smeltery area	1. No occupational exposure and 2. Working close to the lead smeltery area or previous occupational exposure	17. 4.1972	6	1.00	1.04	0.01
		18. 4.1972	10	1.00	1.00	0.01
		19. 4.1972	7	1.00	1.01	0.01
		20. 4.1972	5	1.00	0.98	0.02
		21. 4.1972	7	1.00	1.00	0.01
		24. 4.1972	3	1.00	1.03	0.01
		25. 4.1972	4	1.00	1.03	0.03
		26. 4.1972	7	0.99	1.00	0.03
		3. 5.1972	8	0.98	1.01	0.02
		4. 5.1972	9	0.99	1.01	0.02
		5. 5.1972	8	1.00	1.01	0.01
IV Occupational exposure	1. Lead article manufacture TOP	1. 6.1970	6	0.97	0.93	0.03
		2. 6.1970	8	0.99	0.99	0.02
		3. 6.1970	8	0.99	0.98	0.02
		4. 6.1970	4	1.00	1.04	0.23
		5. 6.1970	7	0.96	0.96	0.02
		8. 6.1970	6	0.96	0.93	0.05
		9. 6.1970	8	0.83	1.08	0.07
	2. Lead storage battery plant (Munja II)	16. 2.1971	6	1.00	1.05	0.04
		17. 2.1971	4	1.00	1.03	0.33
		23. 2.1971	6	0.98	1.01	0.04
		24. 2.1971	2	1.00	1.00	0.04
		25. 2.1971	4	1.00	0.98	0.02
		2. 3.1971	6	1.00	0.95	0.03
		3. 3.1971	4	0.99	1.00	0.04
	3. Lead storage battery plant (Munja II)	4. 2.1970	4	0.97	1.03	0.04
		5. 2.1970	4	0.99	0.98	0.06
		6. 2.1970	3	1.00	0.99	0.04
		9. 2.1970	3	0.97	1.00	0.03
		10. 2.1970	2	1.00	0.99	0.06
		11. 2.1970	4	0.99	0.95	0.03
		12. 2.1970	2	1.00	0.94	0.05
		17. 2.1970	5	0.89	0.95	0.05
		19. 2.1970	2	1.00	0.97	0.10
		20. 2.1970	2	1.00	1.04	0.03
		23. 2.1970	4	0.95	1.07	0.04
		24. 2.1970	4	1.00	1.08	0.05
		25. 2.1970	3	0.96	1.02	0.04
		2. 3.1970	5	0.95	1.04	0.05

(continued)

TABLE 17. (continued)

Group	Subgroup or location	Date	Number of duplicate samples	Correlation coefficient r	Regression equation constant b and sb
IV Occupational exposure	4. Lead smelting plant (Mezice)	15.11.1971	6	0.98	1.02 0.02
		16.11.1971	15	0.97	1.00 0.02
		17.11.1971	6	0.97	1.00 0.03
		18.11.1971	8	0.94	1.02 0.02
		19.11.1971	4	0.96	1.04 0.03
		20.11.1971	7	0.89	1.01 0.04
		22.11.1971	5	0.94	1.01 0.04

TABLE 18. NUMBER OF SUBJECTS AND SAMPLING SCHEDULE

Group	Subgroup or location	Number of subjects examined	Number of subjects with complete biological data	Time of blood and urine sampling
I Rural area	Bohinjska Bela	50	49	10-12 July 1972
	Bovec	48	47	5-7 July 1972
	Tolmin	46	45	28-30 June 1972
II Urban area	Postmen	51	44	16-20 April 1973
	Gas station employees	26	22	3 June - - 1 July 1971
	Streetcar drivers	46	43	28 Oct-3 Nov 1970
	Customs officers	78	75	7-20 July 1971
	Traffic policemen	35	27	16-23 June 1971 and 27-28 Oct 1971
III Lead smeltery area	No occupational exposure	35	32	
	Working close to the smeltery or previous occupational exposure	45	42	18 April - - 5 May 1972
IV occupationally exposed	Lead article manufacture (TOP)	52	47	4-9 June 1970
	Lead storage battery plant Munja II	33	33	16 Febr. - - 8 March 1971
	Lead Storage battery plant Munja I	50	47	4 Febr. - - 2 March 1970
	Lead smelting plant Mezice	71	51	15-22 Nov. 1971
I - IV	Total number of subjects	666	604	

TABLE 19. ARITHMETIC MEANS WITH STANDARD DEVIATIONS FOR ALL BIOLOGICAL PARAMETERS

Group	Subgroup or location	N	Blood									
			Hb g/100 ml		Htc cm^3 %		BpE/ 10^6E		Rtc %0		G-6PD units 100 ml E	
			$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
I Rural area	1. Bohinjska Bela	49	15.7	1.03	43.7	2.16	88	343.8	9	3.3	168.4	8.35
	2. Bovec	47	16.0	1.28	44.1	2.01	0	0.0	9	2.4	179.8	19.34
	3. Tolmin	45	15.7	1.00	44.1	2.24	98	295.0	10	3.5	185.9	19.37
	I 1-3	141	15.8	1.11	44.0	2.13	61	264.2	9	3.1	177.8	17.84
II Urban area	1. Postmen and other post office workers	44	16.1	0.80	44.8	1.53	366	593.0	12	4.5	211.6	26.45
	2. Gas station employees	22	15.9	1.03	44.8	2.15	195	440.2	13	2.5	185.7	14.30
	3. Streetcar drivers	43	15.1	0.68	44.0	0.31	0	0.0	9	1.8	174.3	23.71
	4. Customs officers	75	15.5	1.42	44.4	2.65	493	712.3	17	4.6	187.0	13.81
	5. Traffic policemen	27	15.9	0.86	44.7	1.78	93	220.0	12	3.5	170.7	12.63
	II 1-5	211	15.6	1.12	44.5	2.18	284	561.5	13	4.9	187.3	23.61
III Lead smeltery area	1. No occupational exposure	32	16.0	1.44	45.0	1.69	878	1162.2	17	6.8	173.0	9.87
	2. Working close to the lead smeltery or previous occupational exposure	42	16.0	1.52	44.9	1.75	1376	1332.7	18	5.3	175.2	10.10
	III 1-2	74	16.0	1.48	45.0	1.71	1161	1277.8	18	6.0	174.3	10.00
IV Occupational exposure	1. Lead article manufacture (TOP)	47	15.0	0.92	43.7	1.82	1068	1066.9	16	3.4	185.3	25.41
	2. Lead storage battery plant (Munja II)	33	14.8	1.29	43.4	0.75	106	238.4	13	3.4	184.5	24.83
	IV 1-2	80	14.9	1.09	43.6	1.48	671	833.4	15	3.4	185.0	25.15
	3. Lead storage battery plant (Munja I)	47	15.3	1.01	43.4	1.63	347	487.2	15	3.8	182.7	32.59
	4. Lead smelting plant (Mezice)	51	14.4	1.49	43.4	2.30	2306	1791.5	22	8.5	165.4	16.48
	IV 1-4	178	14.9	1.24	43.5	2.07	1054	1423.5	17	6.3	178.8	26.56

(continued)

TABLE 19. (continued)

Group	Subgroup or location	GSH mg/100 ml blood		ALAD units/ 1 ml E		Pb µg/100 ml blood			
						Original values		Standard Hb adjust. values	
		$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
I Rural area	1. Bohinjska Bela	39.7	7.42	152.3	41.50	7.9	4.44	8.0	4.46
	2. Bovec	41.3	5.69	156.5	39.10	11.4	4.84	11.2	4.75
	3. Tolmin	32.0	6.92	164.9	37.18	10.5	3.96	10.6	3.96
	I 1-3	37.8	7.79	157.7	39.43	9.9	4.65	9.9	4.61
II Urban area	1. Postmen and other post office workers	34.4	6.79	123.5	33.84	18.3	9.31	17.9	9.16
	2. Gas station employees	37.2	4.50	71.9	43.94	12.6	6.29	12.4	6.04
	3. Streetcar drivers	37.6	3.92	41.8	23.38	24.3	10.47	25.5	11.23
	4. Customs officers	35.9	2.95	69.6	21.59	10.4	3.25	10.7	3.25
	5. Traffic policemen	36.5	3.26	86.0	22.89	12.2	5.13	12.2	5.35
	II 1-5	36.1	4.48	77.5	38.78	15.3	8.91	15.6	9.25
III Lead smeltery area	1. No occupational exposure	40.1	5.71	31.6	17.13	31.9	6.30	31.9	6.92
	2. Working close to the lead smeltery or previous occupational exposure	39.8	7.76	20.1	14.00	62.7	15.65	62.7	17.27
	III 1-2	39.5	6.90	25.1	16.36	49.4	19.75	49.4	20.62
IV Occupational exposure	1. Lead article manufacture (TOP)	35.3	3.48	11.1	8.97	43.6	16.00	45.6	16.52
	2. Lead storage battery plant (Munja II)	35.2	4.72	22.7	14.47	47.3	22.89	51.1	24.92
	IV 1-2	35.3	4.03	15.9	11.55	45.1	19.17	47.9	20.39
	3. Lead storage battery plant (Munja I)	37.3	7.39	13.8	13.17	91.8	30.10	95.7	31.80
	4. Lead smelting plant (Mezice)	39.0	4.22	5.2	2.89	54.1	11.59	60.5	15.74
	IV 1-4	36.9	5.38	12.3	11.92	60.0	28.56	64.1	30.12

(continued)

TABLE 19. (continued)

Group	Subgroup or location	Urine			
		ALA mg/100 ml		Coproporphyrin µg/100 ml	
		$\bar{X}$	SD	$\bar{X}$	SD
I Rural area	1. Bohinjska Bela	0.39	0.128	7	3.4
	2. Bovec	0.57	0.187	7	2.8
	3. Tolmin	0.50	0.233	7	3.0
	I 1-3	0.48	0.199	7	3.1
II Urban area	1. Postmen and other post office workers	0.22	0.098	12	9.1
	2. Gas station employees	0.37	0.126	21	23.2
	3. Streetcar drivers	0.31	0.128	15	12.0
	4. Customs officers	0.39	0.106	20	8.8
	5. Traffic policemen	0.33	0.106	14	7.8
	II 1-5	0.33	0.127	17	12.0
III Lead smeltery area	1. No occupationsl exposure	0.70	0.411	24	23.0
	2. Working close to the lead smeltery or previous occupational exposure	1.30	1.554	35	34.1
	III 1-2	1.04	1.233	30	30.1
IV Occupational exposure	1. Lead article manufacture (TOP)	0.58	0.470	23	19.2
	2. Lead storage battery plant (Munja II)	0.75	0.745	20	12.4
	IV 1-2	0.65	0.598	22	16.8
	3. Lead storage battery plant (Munja I)	1.17	1.012	28	20.3
	4. Lead smelting plant (Mezice)	3.13	2.043	102	90.4
	IV 1-4	1.50	1.652	46	61.5

TABLE 20. HEMOGLOBIN (Hb g/100 ml)

Group	Subgroup or location	N	$\bar{X}$ ± SD	M	Range	N	M_G	σ_G	95% C.I.
I Rural area	1. Bohinjska Bela	49	15.7±1.03	15.7	13.2-17.5	50	15.7	1.08	17.5
	2. Bovec	47	16.0±1.28	16.1	11.7-19.4	48	15.7	1.08	17.6
	3. Tolmin	45	15.7±1.00	15.6	13.8-18.1	46	16.0	1.09	18.0
	I 1-3	141	15.8±1.11	15.7	11.7-19.4	144	16.0	1.08	18.0
II Urban area	1. Postmen and other post office workers	44	16.1±0.80	16.0	14.2-17.5	51	16.0	1.06	18.3
	2. Gas station employees	22	15.9±1.03	16.0	13.7-17.7	26	16.0	1.08	18.1
	3. Streetcar drivers	43	15.1±0.68	15.2	13.6-16.5	46	15.1	1.05	16.5
	4. Customs officers	75	15.5±1.42	15.6	8.0-17.9	76	15.5	1.07	17.5
	5. Traffic policemen	27	15.9±0.86	16.0	13.9-16.9	35	16.0	1.03	17.0
	II 1-5	211	15.6±1.12	15.7	8.0-17.9	234	15.5	1.06	17.5
III Lead smeltery area	1. No occupational exposure	32	16.0±1.44	16.0	12.9-19.4	35	15.8	1.11	18.5
	2. Working close to lead smeltery or previous occupational exposure	42	16.0±1.52	16.2	12.2-18.8	45	16.0	1.10	18.6
	III 1-2	74	16.0±1.48	16.1	12.2-19.4	80	16.0	1.10	18.6
IV Occupational exposure	1. Lead article manufacture (TOP)	47	15.0±0.92	14.9	13.0-17.0	53	14.8	1.06	16.5
	2. Lead storage battery plant (Munja II)	33	14.8±1.29	15.0	10.3-16.7	33	15.3	1.05	16.5
	IV 1-2	80	14.9±1.09	14.9	10.3-17.0	86	14.7*		
	3. Lead storage battery plant (Munja I)	47	15.3±1.01	15.3	13.0-17.7	49	15.3	1.06	16.8
	4. Lead smelting plant (Mezice)	51	14.4±1.49	14.5	9.0-16.5	71	14.5	1.08	16.5
	IV 1-4	178	14.9±1.24	15.0	9.0-17.7	206	14.6*		

* Approximate values, frequency distribution not log-normal.

TABLE 21. HEMATOCRIT (Htc cm^3 %)

Group	Subgroup or location	N	$\bar{X}$ ± SD	M	Range
I Rural area	1. Bohinjska Bela	49	43.7±2.16	43.5	39.5-49.0
	2. Bovec	47	44.1±2.01	44.3	38.5-48.5
	3. Tolmin	45	44.1±2.24	43.8	40.5-50.0
	I 1-3	141	44.0±2.13	44.0	38.5-50.0
II Urban area	1. Postmen and other post office workers	44	44.8±1.53	44.5	41.0-48.0
	2. Gas station employees	22	44.8±2.15	44.8	39.0-48.0
	3. Streetcar drivers	43	44.0±0.31	44.0	39.5-49.0
	4. Customs officers	75	44.4±2.65	44.5	31.0-49.0
	5. Traffic policemen	27	44.7±1.78	44.5	41.0-48.0
	II 1-5	211	44.5±2.18	44.5	31.0-49.0
III Lead smeltery area	1. No occupational exposure	32	45.0±1.69	45.0	41.0-48.0
	2. Working close to lead smeltery or previous occupational exposure	42	44.9±1.75	44.6	40.5-50.0
	III 1-2	74	45.0±1.71	45.0	40.5-50.0
IV Occupational exposure	1. Lead article manufacture (TOP)	47	43.7±1.82	43.6	40.0-47.0
	2. Lead storage battery plant (Munja II)	33	43.4±0.75	43.4	36.0-47.5
	IV 1-2	80	43.6±1.48	43.3	36.0-47.5
	3. Lead storage battery plant (Munja I)	47	43.4±1.63	43.2	39.5-46.7
	4. Lead smelting plant (Mezice)	51	43.4±2.30	43.4	36.0-47.0
	IV 1-4	178	43.5±2.07	43.3	36.0-47.5

TABLE 22. BASOPHILIC STIPPLED CELLS (BpE/10^6 E)

Group	Subgroup or location	N	$\bar{X}$ ± SD	M	Range
I Rural area	1. Bohinjska Bela	49	88± 343.8	0	0-2100
	2. Bovec	47	0± 0.0	0	0-0
	3. Tolmin	45	98± 295.0	0	0-1200
	I 1-3	141	61± 264.2	0	0-2100
II Urban area	1. Postmen and other post office workers	44	366± 593.0	0	0-3000
	2. Gas station employees	22	195± 440.2	0	0-1800
	3. Streetcar drivers	43	0± 0.0	0	0
	4. Cutoms officers	75	493± 712.3	0	0-2600
	5. Traffic policemen	27	93± 220.0	0	0- 800
	II 1-5	211	284± 561.5	0	0-3000
III Lead smeltery	1. No occupational exposure	32	878±1162.2	350	0-4400
	2. Working close to lead smeltery or previous occupational exposure	42	1376±1332.7	1000	0-3900
	III 1-2	74	1161±1277.8	600	0-4400
IV Occupational exposure	1. Lead article manufacture (TOP)	47	1068±1066.9	795	0-4800
	2. Lead storage battery plant (Munja II)	33	106± 238.4	0	0- 800
	IV 1-2	80	671± 833.4	125	0-4800
	3. Lead storage battery plant (Munja I)	47	347± 487.2	0	0-1800
	4. Lead smelting plant (Mezice)	51	2306±1791.5	2250	300-7800
	IV 1-4	178	1054±1423.5	500	300-7800

TABLE 23. RETICULOCYTES (Rtc ‰)

Group	Subgroup or location	N	$\bar{X}$ ± SD	M	Range	N	M_G	σ_G	95% C.I.
I Rural area	1. Bohinjska Bela	49	9 ± 3.3	8	5 - 19	50	7.7	1.43	13.8
	2. Bovec	47	9 ± 2.4	9	5 - 15	48	9.2	1.49	17.5
	3. Tolmin	45	10 ± 3.5	10	6 - 22	46	8.5	1.39	14.8
	I 1-3	141	9 ± 3.1	9	5 - 22	144	8.5	1.44	15.5
II Urban area	1. Postmen and other post office workers	44	12 ± 4.5	12	5 - 28	51	11.4	1.49	21.5
	2. Gas station employees	22	13 ± 2.5	12	9 - 18	26	12.0	1.27	18.0
	3. Streetcar drivers	43	9 ± 1.8	8	6 - 12	46	8.1	1.26	12.5
	4. Customs officers	75	17 ± 4.6	15	10 - 30	78	15.2	1.35	25.0
	5. Traffic policemen	27	12 ± 3.5	11	9 -19	35	11.6	1.31	18.0
	II 1-5	211	13 ± 4.9	12	5 - 30	236	11.5	1.48	21.8
III Lead smeltery area	1. No occupational exposure	32	17 ± 6.8	16	8 - 43	35	15.5	1.48	30.0
	2. Working close to lead smeltery or previous occupational exposure	42	18 ± 5.3	19	8 -30	45	17.2	1.37	28.8
	III 1-2	74	18 ± 6.0	18	8 - 43	80	16.5	1.36	27.8
IV Occupational exposure	1. Lead article manufacture (TOP)	47	16 ± 3.4	16	10 - 25	53	15.0	1.26	22.3
	2. Lead storage battery plant (Munja II)	33	13 ± 3.4	11	8 - 19	33	12.3	1.32	19.5
	IV 1-2	80	15 ± 3.4	15	8 - 25	86	14.2	1.28	21.0
	3. Lead storage battery plant (Munja I)	47	15 ± 3.8	15	6 - 30	50	14.2	1.23	20.1
	4. Lead smelting plant (Mezice)	51	22 ± 8.5	20	12 - 60	71	18.0	1.53	37.0
	IV 1-4	178	17 ± 6.3	16	6 - 60	207	15.3	1.44	28.0

TABLE 24. GLUCOSE-6-PHOSPHATE DEHYDIOGENASE ACTIVITY (G-6PD units/100 ml E)

Group	Subgroup or location	N	$\bar{X}$ ± SD	M	Range	N	M_G	σ_G	95% C.I.
I Rural area	1. Bohinjska Bela	49	168.4± 8.34	168.8	150.4-185.3	50	168	1.04	182
	2. Bovec	47	179.8±19.34	178.4	149.5-215.3	48	186	1.10	212
	3. Tolmin	45	185.9±19.37	185.2	152.7-219.3	46	180	1.11	212
	I 1-3	141	177.8±17.84	173.4	149.5-219.3	144	177	1.07	200
II Urban area	1. Postmen and other post office workers	44	211.6±26.45	206.7	169.8-276.0	50	210	1.12	255
	2. Gas station employees	22	185.7±14.30	188.5	150.9-208.2	25	188	1.07	210
	3. Streetcar drivers	43	174.3±23.71	173.8	125.8-239.4	46	175	1.13	214
	4. Customs officers	75	187.0±13.81	186.7	159.8-211.3	76	188	1.07	210
	5. Traffic policemen	27	170.7±12.63	172.9	148.9-194.2	34	170	1.07	190
	II 1-5	211	187.3±23.61	187.6	125.8-276.0	231	187	1.12	230
III Lead smeltery area	1. No occupational exposure	32	173.0± 9.87	172.3	158.2-196.1	35	175	1.06	190
	2. Working close to lead smeltery or previous occupational exposure	42	175.2±10.10	174.7	156.0-200.1	45	176	1.07	195
	III 1-2	74	174.3±10.00	173.9	156.0-200.1	80	175	1.06	191
IV Occupational exposure	1. Lead article manufacture (TOP)	47	185.3±25.41	181.0	141.1-247.4	53	182	1.15	227
	2. Lead storage battery plant (Munja II)	33	184.5±24.83	181.7	144.1-255.7	33	183	1.11	220
	IV 1-2	80	185.0±25.15	181.4	141.1-255.7	96	182	1.14	225
	3. Lead storage battery plant (Munja I)	47	182.7±32.59	179.0	123.5-255.7	50	180	1.18	240
	4. Lead smelting plant Mezice	51	165.4±16.48	159.7	140.1-200.6	71	165	1.10	193
	IV 1-4	178	178.8±26.56	176.4	123.5-255.7	207	175	1.15	222

TABLE 25. GLUTATHIONE (GSH mg/100 ml blood)

Group	Subgroup or location	N	$\bar{X}$ ± SD	M	Range	N	M_G	σ_G	95% C.I.
I Rural area	1. Bohinjska Bela	49	39.7±7.42	38.6	19.5-56.8	50	40.0	1.19	53
	2. Bovec	47	41.3±5.69	40.9	30.0-57.1	48	41.0	1.15	52
	3. Tolmin	45	32.0±6.92	32.7	19.4-47.5	46	32.0	1.22	44
	I 1-3	141	37.8±7.79	38.0	19.4-57.1	144	37.0	1.21	50
II Urban area	1. Postmen and other post office workers	44	34.4±6.79	35.3	21.5-47.9	50	34.2	1.23	48
	2. Gas station employees	22	37.2±4.50	36.3	33.0-54.1	26	37.0	1.08	43
	3. Streetcar drivers	43	37.6±3.92	36.0	29.0-45.8	46	37.0	1.11	44
	4. Customs officers	75	35.9±2.95	35.9	27.7-41.6	78	36.0	1.08	41
	5. Traffic policemen	27	36.5±3.26	35.7	32.7-47.0	35	36.0	1.08	41
	II 1-5	211	36.1±4.48	36.3	21.5-54.1	235	36.0	1.11	43
III Lead smeltery area	1. No occupational exposure	32	40.1±5.71	40.0	32.0-52.5	35	40.0	1.15	51
	2. Working close to lead smeltery or previous occupational exposure	42	39.8±7.76	37.7	30.0-68.3	45	38.0	1.19	50
	III 1-2	74	39.9±6.90	38.3	30.0-68.3	80	39.0	1.15	50
IV Occupational exposure	1. Lead article manufacture (TOP)	47	35.3±3.48	35.6	27.7-41.3	53	34.5	1.10	40
	2. Lead storage battery plant (Munja II)	33	35.2±4.72	34.8	26.4-45.2	33	35.0	1.13	44
	IV 1-2	80	35.3±4.03	34.8	26.4-46.2	86	34.6	1.13	42
	3. Lead storage battery plant (Munja I)	47	37.3±7.39	35.9	22.4-50.8	50	36.6	1.20	49
	4. Lead smelting plant (Mezice)	51	39.0±4.22	41.5	32.0-47.2	71	38.0	1.10	45
	IV 1-4	178	36.9±5.38	36.3	22.4-50.8	207	36.0	1.15	46

TABLE 26. DELTA-AMINOLEVOLINIC ACID DEHYDRATASE (ALAD units/ml E)

Group	Subgroup or location	N	$\bar{X}$ ± SD	M	Range	N	M_G	σ_G	95% C.I.
I Rural area	1. Bohinjska Bela	49	152.3±41.50	155.6	40.6-244.8	50	145*		
	2. Bovec	47	156.5±39.10	155.8	47.1-233.9	48	150*		
	3. Tolmin	45	164.9±37.18	166.7	75.0-245.5	46	162*		
	I 1-3	141	157.7±39.43	159.1	40.6-245.5	144	152*	(1.28)	230
II Urban area	1. Postmen and other post office workers	44	123.5±33.84	118.5	49.4-193.9	51	118*		
	2. Gas station employees	22	71.9±43.94	61.0	16.3-178.0	26	58	1.84	160
	3. Streetcar drivers	43	41.8±23.38	39.1	10.2-105.8	46	39	1.61	85
	4. Customs officers	75	69.6±21.59	67.9	31.0-151.0	78	67	1.34	108
	5. Traffic policemen	27	86.0±22.89	82.0	52.2-125.8	35	83	1.35	135
	II 1-5	211	77.5±22.89	71.3	10.2-193.9	236	70	1.60	150
III Lead smeltery area	1. No occupational exposure	32	31.6±17.13	27.5	10.0-77.8	35	27.5	1.67	65
	2. Working close to lead smeltery or previous occupational exposure	42	20.1±14.00	15.6	3.1-59.4	45	16.0	1.90	48
	III 1-2	74	25.1±16.36	19.7	3.1-77.8	80	20.2	1.93	60
IV Occupational exposure	1. Lead article manufacture (TOP)	47	11.1±8.97	9.2	1.9-38.0	53	8.3	2.13	30
	2. Lead storage battery plant (Munja II)	33	22.7±14.47	21.8	4.0-77.5	33	20.2	1.62	45
	IV 1-2	80	15.9±11.55	10.3	2.3-77.5	86	10.0	2.43	42
	3. Lead storage battery plant (Munja I)	47	13.8±13.17	7.3	1.7-51.3	50	7.1	2.57	34
	4. Lead smelting plant (Mezice)	51	5.2±2.89	4.6	0.9-12.9	71	4.5	1.84	12
	IV 1-4	178	12.3±11.92	7.6	0.9-77.5	207	7.0	2.47	32

* Approximate values, frequency distribution not log-normal.

TABLE 27. LEAD IN BLOOD* (μg Pb/100 ml blood)

Group	Subgroup or location	N	$\bar{X}$ ± SD	M	Range	N	M_G	σ_G	95% C.I.
I Rural area	1. Bohinjska Bela	49	7.9± 4.44	8.0	0.0-17.5	50	6.7†		
	2. Bovec	47	11.4± 4.84	11.3	0.4-20.8	48	10.8†		
	3. Tolmin	45	10.5± 3.96	11.3	2.2-19.7	46	9.8†		
	I 1-3	141	9.9± 4.65	9.9	0.0-20.8	144	9.2†		
II Urban area	1. Postmen and other post office workers	44	18.3± 9.31	18.7	2.7-36.4	51	15.7†		
	2. Gas station employees	22	12.6± 6.29	12.8	0.0-26.2	26	11.7	1.50	23.5
	3. Streetcar drivers	43	24.3±10.47	23.1	0.0-43.7	46	22.0	1.64	50.0
	4. Customs officers	75	10.4± 3.25	9.9	4.6-21.5	78	10.0	1.40	17.0
	5. Traffic policemen	27	12.2± 5.13	12.8	3.6-23.8	35	12.2		
	II 1-5	211	15.3± 8.91	12.5	0.0-43.7	236	12.5	1.84	34.0
III Lead smeltery area	1. No occupational exposure	32	31.9± 6.30	32.0	18.7-44.5	35	32.0	1.22	45.0
	2. Working close to lead smeltery or previous occupational exposure	42	62.7±15.65	62.5	33.4-96.1	45	63.0	1.28	93.0
	III 1-2	74	49.4±19.75	45.0	18.7-96.1	80	47.0	1.54	100.0
IV Occupational exposure	1. Lead article manufacture (TOP)	47	43.6±16.00	43.5	12.7-72.3	53	42.0†		
	2. Lead storage battery plant (Munja II)	33	47.3±22.89	53.6	7.0-90.0	33	56.0†		
	IV 1-2	80	45.1±19.17	47.1	7.0-90.0	86	44.0†		
	3. Lead storage battery plant (Munja I)	47	91.8±30.10	87.0	29.6-171.6	50	90.0	1.41	160.0
	4. Lead smelting plant (Mezica)	51	54.1±11.59	53.8	33.6-89.8	71	53.0	1.25	79.0
	IV 1-4	178	60.0±28.56	57.4	7.0-171.6	207	52.0	1.62	115.0

* Original values.
† Approximate frequency distribution not log-normal.

TABLE 28. LEAD IN BLOOD* (µg Pb/100 ml blood)

Group	Subgroup or location	N	$\bar{X}$ ± SD	M	Range
I Rural area	1. Bohinjska Bela	49	8.0 ± 4.46	7.8	0.0 - 17.5
	2. Bovec	47	11.2 ± 4.75	11.1	0.4 - 21.5
	3. Tolmin	45	10.6 ± 3.96	10.9	2.2 - 19.0
	I 1-3	141	9.9 ± 4.61	10.0	0.0 - 21.5
II Urban area	1. Postmen and other post office workers	44	17.9 ± 9.16	18.7	3.0 - 36.2
	2. Gas station employees	22	12.4 ± 6.04	11.9	0.0 - 25.5
	3. Streetcar drivers	43	25.5 ± 11.23	23.9	0.0 - 48.9
	4. Customs officers	75	10.7 ± 3.25	10.7	4.2 - 21.5
	5. Traffic policemen	27	12.2 ± 5.35	12.3	3.4 - 24.6
	II 1-5	211	15.6 ± 9.25	12.6	0.0 - 48.9
III Lead smeltery area	1. No occupational exposure	32	31.9 ± 6.92	31.3	19.3 - 48.1
	2. Working close to lead smeltery or previous occupational exposure	42	62.7 ± 17.27	60.0	33.6 - 108.5
	III 1-2	74	49.4 ± 20.62	46.7	19.3 - 108.5
IV Occupational exposure	1. Lead article meanufacture (TOP)	47	45.6 ± 16.52	45.5	15.0 - 79.0
	2. Lead storage battery plant (Munja II)	33	51.1 ± 24.92	60.5	6.6 - 90.9
	IV 1-2	80	47.9 ± 20.39	49.3	6.6 - 90.9
	3. Lead storage battery plant (Munja I)	47	95.7 ± 31.80	90.7	31.4 - 175.1
	4. Lead smelting plant (Mezice)	51	60.5 ± 15.74	59.5	33.4 - 113.5
	IV 1-4	178	64.1 ± 30.12	62.6	6.6 - 175.1

* Hb adjusted values.

TABLE 29. DELTA AMINOLEVULINIC ACID (ALA mg/100 ml urine)

Group	Subgroup or location	N	$\bar{X}$ ± SD	M	Range	N	M_G	σ_G	95% C.I.
I Rural area	1. Bohinjska Bela	49	0.39±0.128	0.37	0.18-0.71	50	0.38	1.36	0.62
	2. Bovec	47	0.57±0.187	0.57	0.19-1.09	48	0.54	1.33	0.88
	3. Tolmin	45	0.50±0.233	0.46	0.15-1.35	45	0.45	1.50	0.88
	I 1-3	141	0.48±0.199	0.46	0.15-1.35	143	0.44	1.47	0.84
II Urban area	1. Postmen and other post office workers	44	0.22±0.098	0.21	0.04-0.40	46	0.20	1.64	0.45
	2. Gas station employees	22	0.37±0.126	0.36	0.20-0.57	22	0.34	1.47	0.65
	3. Streetcar drivers	43	0.31±0.128	0.31	0.10-0.63	44	0.29	1.59	0.60
	4. Customs officers	75	0.39±0.106	0.37	0.16-0.71	76	0.36	1.35	0.60
	5. Traffic policemen	27	0.33±0.106	0.30	0.23-0.75	28	0.30	1.30	0.46
	II 1-5	211	0.33±0.127	0.33	0.04-0.75	215	0.33*	1.48	0.64
III Lead smeltery area	1. No occupational exposure	32	0.70±0.411	0.65	0.19-2.09	30	0.60*		
	2. Working close to lead smeltery or previous occupational exposure	42	1.30±1.554	0.80	0.12-8.32	45	0.83		
	III 1-2	74	1.04±1.233	0.68	0.12-8.32	75	0.70*		
IV Occupational exposure	1. Lead article manufacture (TOP)	47	0.58±0.470	0.47	0.00-2.68	53	0.42	2.21	1.60
	2. Lead storage battery plant (Munja II)	33	0.75±0.745	0.55	0.13-4.34	32	0.48	1.98	1.50
	IV 1-2	80	0.65±0.598	0.50	0.00-4.34	85	0.47	1.91	1.35
	3. Lead storage battery plant (Munja I)	47	1.17±1.012	0.93	0.00-4.00	46	0.90	2.22	3.40
	4. Lead smeltery plant (Mezice)	51	3.13±2.043	2.78	0.68-8.99	63	2.40	1.83	6.60
	IV 1-4	178	1.50±1.652	0.81	0.00-8.99	194	0.89	2.92	5.20

* Approximate value, frequency distribution not log-normal.

TABLE 30. COPROPORPHYRIN (μg/100 ml urine)

Group	Subgroup or location	N	$\bar{X}$ ± SD	M	Range	N	M_G	σ_G	95% C.I.
I Rural area	1. Bohinjska Bela	49	7± 3.4	6	3- 17	49	6.9	1.54	14.2
	2. Bovec	47	7± 2.8	6	2- 16	47	6.6	1.44	12.1
	3. Tolmin	45	7± 3.0	7	2- 17	44	7.3	1.40	12.9
	I 1-3	141	7± 3.1	6	2- 17	140	7.0	1.47	13.4
II Urban area	1. Postmen and other post office workers	44	12± 9.1	11	3- 63	45	9.9	1.58	21.0
	2. Gas station employees	22	21±23.2	14	6-109	27	13.5	1.78	34.0
	3. Streetcar drivers	43	15±12.0	12	4- 54	44	11.7*		
	4. Customs officers	75	20± 8.8	18	1- 43	80	16.6	1.54	36.0
	5. Traffic policemen	27	14± 7.8	12	4- 39	28	11.5	1.68	27.0
	II 1-5	211	17±12.0	14	1-109	224			
III Lead smeltery area	1. No occupational exposure	32	24±23.0	17	4-136	33	19.7	1.65	45.0
	2. Working close to lead smeltery or previous occupational exposure	42	35±34.1	25	1-204	42	26.0	2.11	90.0
	III 1-2	74	30±30.1	21	1-204	75	23.2	2.03	74.0
IV Occupational exposure	1. Lead article manufacture (TOP)	47	23±19.2	17	6-116	52	17.3	1.94	52.0
	2. Lead storage battery plant (Munja II)	33	20±12.4	16	2- 48	33	16.2	2.16	52.0
	IV 1-2	80	22±16.8	17	2-116	85	16.8	1.90	48.0
	3. Lead storage battery plant (Munja I)	47	28±20.3	23	3-116	50	21.2*		
	4. Lead smeltery plant (Mezice)	51	102±90.4	80	7-525	71	86.0*		
	IV 1-4	178	46±61.5	27	2-525	206	25.2*		

* Approximate values, frequency distribution not log-normal.

TABLE 31. COPROPORPHRIN ISOMERS

Expressed as % Copro I

Group	N	$\bar{X}$ ± SD	M	Range	M_G	σ_G	95%
I Rural	140	42.4 ± 11.9	41.8	9-87	40	1.30	62
II Urban	83	43.5 ± 8.4	43.4	30-76	43	1.23	62
III Lead smeltery area	86	32.6 ± 12.5	31.6	11-71	31	1.45	57
IV Occupationally exposed	38	14.6 ± 6.5	13.7	4-32	13.5	1.44	25

Expressed as µg/100 ml Copro III

Group	N	$\bar{X}$ ± SD	Range	M_G	σ_G	95%	M
I Rural	140	3.9 ± 2.0	0.1- 10.5	3.6	1.58	7.9	3.5
II Urban	82	7.5 ± 5.0	0.7- 40.3	6.4	1.64	14.3	6.4
III Lead smeltery area	75	21.6 ± 24.6	0.5-171.4	14.2	2.30	160.0	13.6
IV Occupationally exposed	38	78.6 ± 61.5	5.6-240.0	60.0	2.60	300.0	57.0

TABLE 32. HALF-LIFE OF Cr-51 LABELLED RED CELLS

	N	$\bar{X}$	Range
Subjects without known exposure	20	26.0	23 - 29
Traffic policemen	12	22.5	18 - 25
Exposed workers	10	22.0	19 - 26
Subjects with clinical signs of lead poisoning	8	17.8	12 - 23

TABLE 33. CORRELATION OF BIOLOGICAL INDICES OF LEAD INDUCED CHANGES WITH FOUR LEVELS OF EXPOSURE TO LEAD IN AIR

Biological index	Rank correlation coefficient		Quadriserial correlation coefficient
	linear	log	
Hb	-0.232		-0.268
BpE	0.514		0.417
Rtc	0.525		0.239
G-6PD	-0.080		-0.030
GSH	0.003		-0.017
ALAD	-0.869	-0.863	-0.924
Pb_{adj}	0.810	0.771	0.788
ALA	0.479	0.362	0.413
$COPRO_{Total}$	0.384	0.591	0.417
$COPRO_{III}$			0.895*
$COPRO_{I\%}$	-0.478*	-0.490*	-0.779*

* Calculated from 335 results against 604 results used in other calculations. The difference is on account of group II (only 2 subgroups included) and group IV (only subgroup 4 with highest exposure to lead included).

TABLE 34. ANALYSIS OF VARIANCE

Biological parameter	Variance between groups		Variance within groups							
			I		II		III		IV	
	F	P	F	P	F	P	F	P	F	P
Hb	24.675	0.0000	1.314	0.2713	5.609	0.0005	0.039	0.8380	5.288	0.0020
Htc	11.556	0.0000	0.390	0.6835	0.984	0.5815	0.031	0.8553	0.180	0.9097
BpE	5.242	0.0020	insufficient data		insufficient data		1.086	0.3034	7.936	0.0002
Rtc	73.562	0.0000	1.927	0.1473	32.033	0.0000	0.498	0.5104	22.915	0.0000
G-6PD	9.667	0.0000	13.963	0.0000	27.578	0.0000	0.888	0.6487	6.707	0.0006
GSH	7.997	0.0001	24.956	0.0000	3.274	0.0125	0.048	0.8221	5.625	0.0014
ALAD	636.317	0.0000	1.235	0.2937	49.608	0.0000	10.128	0.0025	19.594	0.0000
Pb	307.926	0.0000	6.683	0.0021	34.935	0.0000	90.927	0.0000	43.972	0.0000
ALA	52.369	0.0000	11.084	0.0001	16.621	0.0000	4.597	0.0333	39.777	0.0000
COPRO	37.519	0.0000	0.422	0.6623	3.868	0.0050	2.211	0.1376	28.492	0.0000

TABLE 35. COEFFICIENTS OF VARIATION

Group	Sub-group	Hb	Rtc	G-6PD	GSH	ALAD	Pb_{adj}	ALA	Copro
I	1	6.6	36.7	5.0	18.7	27.2	55.8	32.8	48.6
	2	8.0	26.7	10.8	13.8	25.0	42.4	32.8	40.0
	3	6.4	35.0	10.4	21.6	22.5	37.4	46.6	42.9
I	1-3	7.0	34.4	10.0	20.6	25.0	46.6	41.5	44.3
II	1	5.0	37.5	12.5	19.7	27.4	51.2	44.5	75.8
	2	6.5	19.2	7.7	12.1	61.1	48.7	34.1	110.5
	3	4.5	20.0	13.6	10.4	55.9	44.0	41.3	80.0
	4	9.2	27.1	7.4	8.2	31.0	30.4	27.2	34.0
	5	5.4	29.2	7.4	8.9	26.6	43.9	32.1	55.7
II	1-5	7.2	37.7	12.6	12.4	50.0	59.3	38.5	70.6
III	1	9.0	40.0	5.7	14.2	54.2	21.7	58.7	95.8
	2	9.5	29.4	5.8	19.5	69.7	27.5	119.5	97.4
III	1-2	9.3	33.3	5.7	17.3	65.2	41.7	118.6	100.3
IV	1	6.1	21.3	13.7	11.1	80.8	36.2	81.0	83.5
	2	8.7	26.2	13.5	22.7	63.7	48.8	99.3	62.0
	3	6.6	25.3	17.8	19.8	95.4	33.2	86.5	72.5
	4	10.3	29.5	10.0	10.8	55.6	26.0	65.3	88.6
IV	1-4	8.3	37.1	14.9	14.6	96.9	47.0	110.1	133.7

TABLE 36. CORRELATION BETWEEN BIOLOGICAL PARAMETERS BY GROUPS AND FOR ALL SUBJECTS

Group	x \ y	Hb	BpE	Rtc	G-6PD	GSH	ALAD	Pb_{adj}	ALA	Copro
I	Hb		.049	.054	-.016	.164	-.038	.034	.061	-.070
II			.072	.032	.098	-.072	.221	-.106	-.072	-.005
III			.126	.166	.053	.152	.007	-.256	-.009	.100
IV			-.348	-.351	-.098	.091	.073	-.108	-.314	-.375
I-IV			-.175	-.161	.000	.103	.225	-.257	-.246	-.269
I	BpE	.049		.675	.013	-.050	.054	-.105	-.127	-.076
II		.072		.742	.084	-.003	.074	-.185	-.045	.070
III		.126		.914	.231	-.103	-.427	.327	.445	.396
IV		-.348		.893	-.141	-.009	-.312	-.032	.498	.438
I-IV		-.175		.847	.078	0.52	-.368	.352	.530	.478
I	Rtc	.054	.675		.050	-.136	.128	.051	-.044	.011
II		.032	.742		.113	-.015	.047	.392	.157	.140
III		.166	.914		.251	-.034	-.345	.215	.302	.255
IV		-.351	.893		-.123	-.021	-.212	.118	.472	.438
I-IV		-.161	.847		-.024	-.013	-.448	.388	.444	.437
I	G-6PD	-.016	.013	.050		-.110	.105	.136	.124	-.005
II		.098	.084	.113		-.196	.378	-.052	-.253	-.058
III		.053	.231	.251		-.060	-.157	.075	0.59	.126
IV		-.098	-.141	-.123		-.168	.179	.046	-.143	-.119
I-IV		.000	.078	-.024		-.168	.123	-.065	-.134	-.093
I	GSH	.164	-.050	-.136	-.110		-.090	.018	.123	-.118
II		-.072	-.003	-.015	-.196		-.192	.055	.094	.081
III		.152	-.103	-.034	-.060		.005	.022	-.132	-.206
IV		.091	-.009	-.021	-.164		-.152	.058	.051	.029
I-IV		.103	.055	-.013	-.168		-.056	.053	.031	-.005
I	ALAD	-.038	.054	.128	.105	-.090		-.055	-.017	.035
II		.221	.074	.047	.378	-.192		-.048	-.190	-.088
III		.007	-.427	-.345	-.157	.005		-.537	-.386	-.430
IV		.073	-.312	-.212	.179	-.153		.001	-.302	-.251
I-IV		.225	-.368	-.448	.123	-.056		-.615	-.339	-.356

(continued)

TABLE 36. (continued)

Group	x \ y	Hb	BpE	Rtc	G-6PD	GSH	ALAD	Pb_{adj}	ALA	Copro
I	Pb_{adj}	.034	-.105	.051	.136	.018	-.055		.062	.027
II		-.106	-.185	.392	-.052	.055	-.048		-.213	-.074
III		-.256	.327	.215	.075	.022	-.537		.377	.304
IV		-.108	-.032	.118	.046	.058	.001		.155	.061
I-IV		-.257	.352	.388	-.065	.053	-.615		.441	.350
I	ALA	.061	-.127	-.044	.124	.123	-.017	.062		.190
II		.072	-.045	.157	-.253	.094	-.190	-.213		.246
III		-.009	.445	.302	.059	-.132	-.386	.377		.757
IV		-.314	.498	.472	-.143	.051	-.302	.155		.653
I-IV		-.245	.530	.444	-.134	.031	.339	.441		.697
I	Copro	-.070	-.076	.011	-.005	-.118	.035	.027	.190	
II		-.005	.070	.140	-.058	.081	-.088	-.074	.246	
III		.100	.396	.255	.126	-.206	-.430	.304	.757	
IV		-.375	.435	.438	-.119	.029	-.251	.061	.653	
I-IV		-.269	.478	.437	-.093	-.005	-.356	.350	.697	

TABLE 37. AVERAGED COEFFICIENTS OF CORRELATION BETWEEN BIOLOGICAL PARAMETERS FOR TOTAL POPULATION

Biological parameter	Hb	BpE log BpE	Rtc	G-6PD	GSH	ALAD log ALAD	Pb_{adj}	ALA log ALA	Copro log Copro
Hb		-.071	-.052	-.085	.105	-.003	-.208	-.107	-.133
BpE	-.071		.821	.030	-.080	-.052	.198	.248	.173
log BpE						-.207	.236	.172	.199
Rtc	-.052	.821		.061	-.069	.005	.159	.196	.169
G-6PD	-.085	.030	.061		.050	.046	.034	.050	.058
GSH	.105	-.080	-.069	-.050		-.037	-.002	-.093	-.099
ALAD	.003	-.052	-.005	.046	-.037		-.020	-.053	-.034
log ALAD		-.207					.102	-.238	-.174
Pb	-.208	.198	.159	.034	-.002	-.020		.201	.136
adj		.236				-.102		.163	.107
ALA	-.107	.248	.196	.050	-.093	-.053	.201		.492
log ALA		.172				-.237	.163		.348
Copro	-.133	.173	.169	.058	-.099	-.034	.136	.492	
log Copro		.199				-.174	.107	.348	
Copro I	-.040	-.105	.124	-.017	-.080	.143	-.083	-.100	.159
log Copro I						.244		-.089	-.196

TABLE 38. AVERAGED COEFFICIENTS OF CORRELATION BETWEEN BIOLOGICAL PARAMETERS FOR GROUP III

Biological parameter	Hb	BpE log BpE	Rtc	G-6PD	GSH	ALAD log ALAD	Pb_{adj}	ALA log ALA	Copro log Copro
Hb		.124	.164	.050	.153	.002	-.412	-.016	.098
BpE log BpE	.124		.960	.203	-.079	-.380 -.426	.276 .228	.353 .207	.290 .333
Rtc	.164	.920		.245	-.032	-.339	.231	.291	.246
G-6PD	.050	.203	.245		-.058	-.127	-.012	.033	.109
GSH	.153	-.079	-.032	-.058		-.004	.062	.130	-.205
ALAD log ALAD	.002	-.380 -.426	-.339	-.127	-.004		-.441 -.564	-.330 -.460	-.401 -.527
Pb adj	-.412	.276 .228	.231	-.012	.062	-.441 -.564		.302 .317	.268 .277
ALA log ALA	-.016	.353 .207	.291	.033	.130	-.330 -.460	.302 .317		.749 .613
Copro log Copro	.098	.290 .333	.246	.109	-.205	-.401 -.527	.268 .277	.749 .613	

TABLE 39. AVERAGED COEFFICIENTS OF CORRELATION BETWEEN BIOLOGICAL PARAMETERS FOR GROUP IV

Biological parameter	Hb	BpE log BpE	Rtc	G-6PD	GSH	ALAD log ALAD	Pb_{adj}	ALA log ALA	Copro log Copro
Hb		-.279	-.283	-.195	.151	.001	-.276	-.224	-.295
BpE	-.279		.862	.038	-.196	-.053	.240	.266	.187
log BpE						-.141	.290	.254	.183
Rtc	-.283	.862		.050	-.192	.042	.235	.236	.205
G-6PD	-.195	.038	.050		-.086	.072	.064	.087	.084
GSH	.151	-.196	-.192	-.086		-.053	-.032	-.175	-.155
ALAD	.001	-.053	.042	.072	-.053		.001	.099	-.037
log ALAD		-.141					-.055	-.282	-.168
Pb	-.276	.240	.235	.064	-.032	.001		.203	.144
adj		.290				-.055		.202	.114
ALA	-.224	.266	.236	.087	-.175	-.099	.203		.461
log ALA		.254				-.282	.202		.386
Copro	-.295	.187	.205	.084	-.155	-.037	.144	.461	
log Copro		.183				.168	.114	.386	

REFERENCES

1. First year report under Agreement Number 02-302-3 between the Institute for Medical Research and Occupational Health, Yugoslav Academy of Sciences and Arts, Zagreb, Yugoslavia and the U.S. Environmental Research Agency, Research Triangle Park, N.C. 1969-1974.

2. Second year report under Agreement Number 02-302-3 between the Institute for Medical Research and Occupational Health, Yugoslav Academy of Sciences and Arts, Zagreb, Yugoslavia and the U.S. Environmental Research Agency, Research Triangle Park, N.C. 1969-1974.

3. Survey of Lead in the Atmosphere of Three Urban Communities, U.S. DHEW, PHS Publication No. 999-AP-12, Cincinnati, 1965.

4. Methods of Measuring Air Pollution, Report of the Working Party on Methods of Measuring Air Pollution and Survey Techniques, OECD, Paris, 1964.

5. Lee, R.E. and Flesh, J.P. A gravimetric method for determining the size distribution of particulates suspended in air, presented at the Annual Meeting of the Air Pollution Control Association, New York, 1969.

6. Sherwood, R.J. and Greenhalgh, D.M.S. A Personal Air Sampler, Ann. Occup. Hyg., 2:127, 1960.

7. Ornstein, A.J. (Ed) Proc. Pneumoconiosis Conference, Johannesburg 1959, J. and A. Churchill, London, 1960.

8. Fugas, M. and Pauković, R. Microdetermination of lead as chromate by the Ring-oven Technique, Anal. Chim. Acta 49:356, 1970.

9. Fugas, M., Pauković, R., Vadić, V. and Hrsak, J. A New Method for the Determination of Lead in Smoke Samples, Proceedings of the Second International Clean Air Congress, Washington, 359-361, 1971.

10. Daines, R.H., Smith, D.W., Feliciano, A. and Trout, J.R. Air Levels of Lead Inside and Outside of Homes, Industrial Medicine 41:26, 1972.

11. O'Donnell, H. The Particle Size Distribution of Suspended Particulate Matter Collected by the National Air Sampling Network High Volume Sampler and Some Data on the Size Distribution of the Urban Aerosol in Pittsburgh, M.S. Thesis, University of Pittsburgh, 1968.

12. Hu, J.N.H. An Improved Impactor for Aerosol Studies - Modified Andersen Sampler, Environ. Sci. Technol., 5:251, 1971.

13. Fugas, M., Hrsak, J. and Steiner-Skreb, D. Wall losses with the Modified Andersen Cascade Impactor, Dixieme Colloque sur les Atmospheres Polluees, Paris, 1972.

14. Wilder, B., Fugas, M., Hrsak, J. and Vuković, A. Evaluation of the Modified Andersen Cascade Impactor, Proceedings of the Third International Clean Air Congress, Dusseldorf, 1973, VDI - Verlag, Dusseldorf, 1973, C 9.

15. Fugas, M., Wilder, B., Pauković, R., Hrsak, J. and Steiner-Skreb, D. Concentration Levels and Particle Size Distribution of Lead in the Air of an Urban and an Industrial Area as a Basis for the Calculation of Population Exposure, Proceedings of the International Symposium on Environmental Health Aspects of Lead, Amsterdam 1972, Commission of the European Communities, Luxembourg, pp. 961-967, 1973.

16. International Committee for Standardization in Haematology. Brit. J. Haematol., 13 (suppl.):71, 1967.

17. Wintrobe M.M. Clinical Hematology, 4th Ed., Lea & Febiger Philadelphia, 1956.

18. Hamel C. Dtsch. Arch. klin. Med., 67:357, 1900.

19. Gray S.J., Sterling K. J. Clin. Invest., 29:1604, 1950.

20. Veall N., Vetter H. Radioisotope Techniques in Clinical Research and Diagnosis, Butterworth, London, p. 239, 1958.

21. Lewis S.M., Simonović I., Meniga A. Arh. hig. rada, 9:393, 1958.

22. Zinkham W.H., Lenhard R.E., Childs, B. Bull. Johns Hopkins Hosp., 102:169, 1958.

23. Beutler E., Duron O., Mikus Kelly B. J. Lab. Clin. Med., 61:882, 1963.

24. Bonsignore D., Calissano P., Cartasegna C. Med. Lavoro, 56:199, 1965.

25. Weber A.O., Volodar Kata, Vouk V.B. Arh. hig. rada, 3:296, 1952.

26. Vouk V.B., Volodar Kata, Weber O.A. Purec Ljerka, Arh. hig. rada, 6:277, 1955.

27. Davis J.R., Andelman S.L. Arch. Environ. Health, 15:53, 1967.

28. Mauzerall O., Granick S. J. Biol. Chem., 232:1141, 1958.

29. Schwartz S., Zieve L., Watson C.J. J. Lab. Clin. Med., 41:663, 1953.

30. Zieve L., Hill E., Schwartz S., Watson C.J. J. Lab. Clin. Med., 41:663, 1953.

31. Koskelo P., Toivonen I. Scandinav. J. Clin. & Lab. Investigation, 18:543, 1966.

32. Eriksen L., Eriksen N., Haavaldsen S. Scandinav. J. Clin. & Lab. Investigation, 14:6, 1962.

33. Asis, M.A., Schwartz S., Watson C.J. J. Lab. Clin. Med., 63:5[illegible], 1964.

APPENDIX A

DATA ON LEAD IN AIR

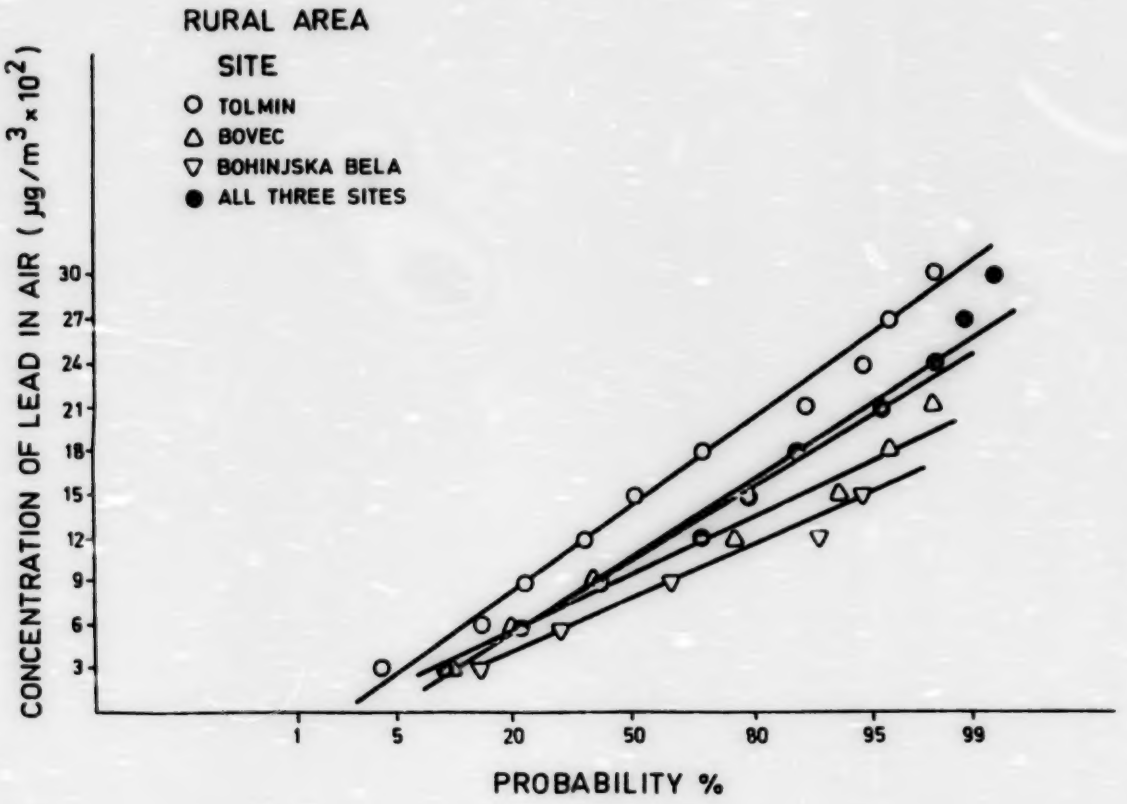

Figure A-1. Cumulative frequency distribution of lead in air for rural area, June 1972 - July 1973

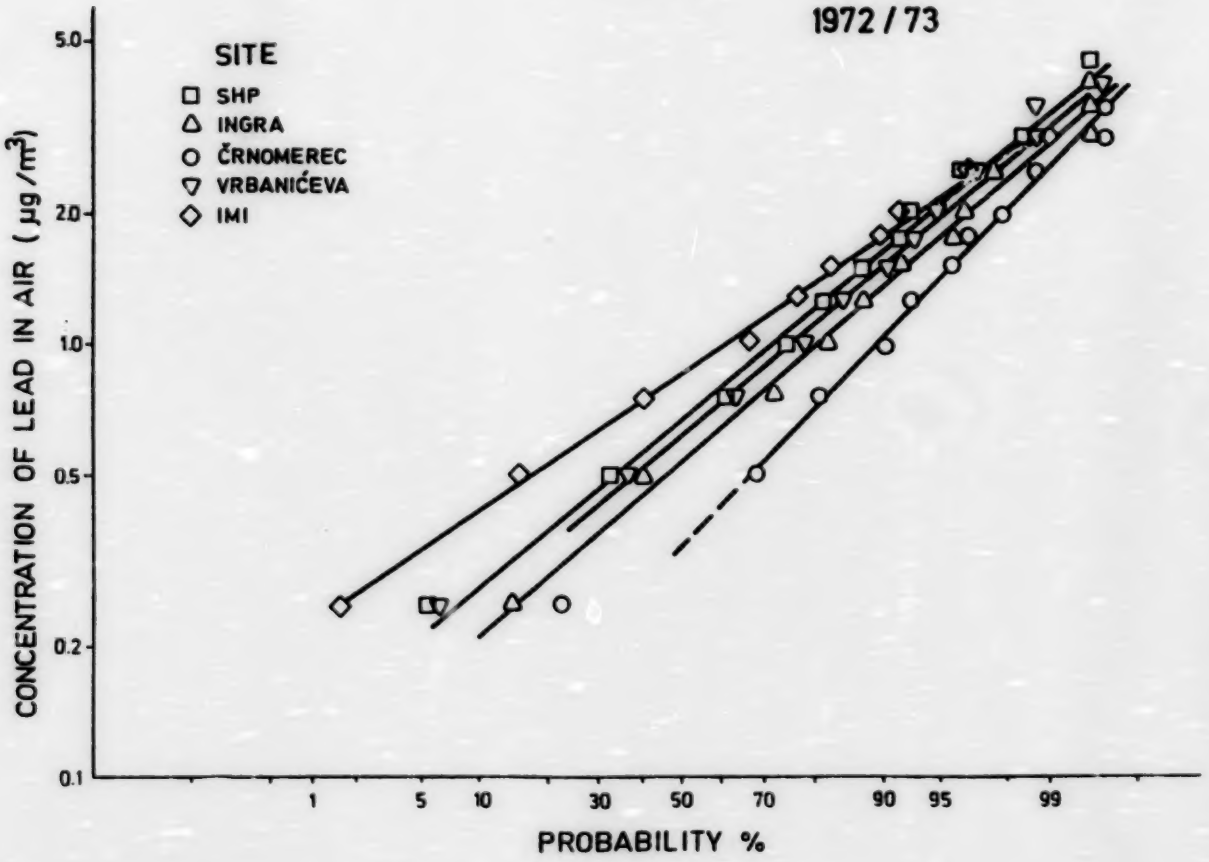

Figure A-2. Cumulative frequency distribution of lead in Zagreb air

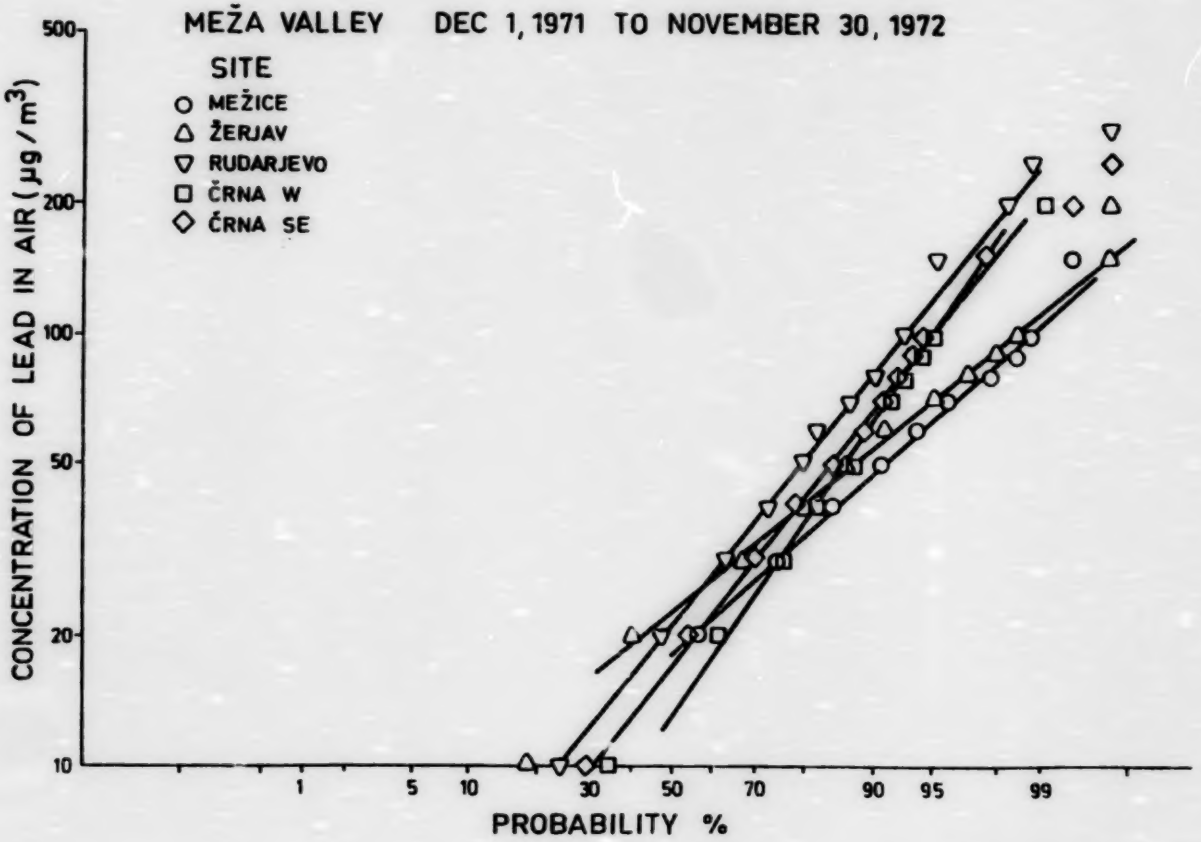

Figure A-3. Cumulative frequency distribution of lead in air for Meza Valley, December 1, 1971 to November 30, 1972.

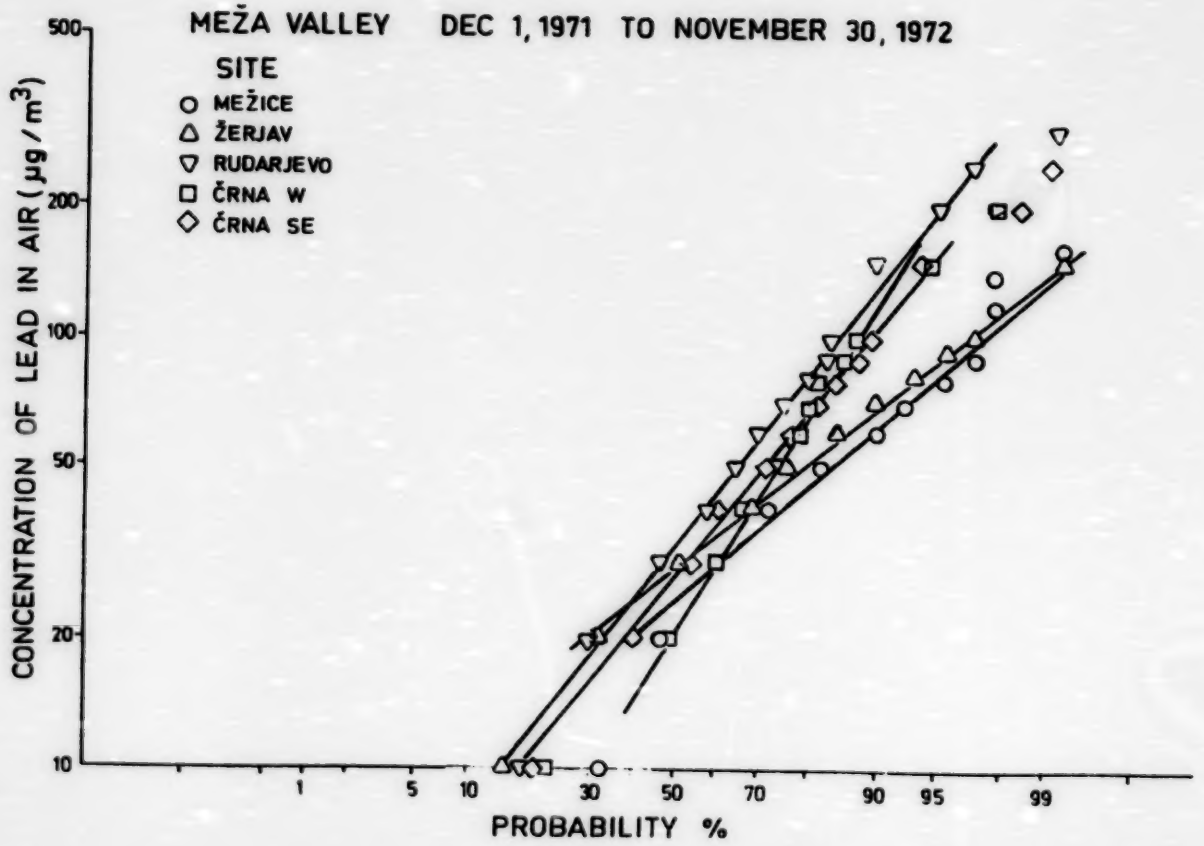

Figure A-4. Cumulative frequency distribution of lead in air for Meza Valley, December 1, 1971 to April 30, 1972.

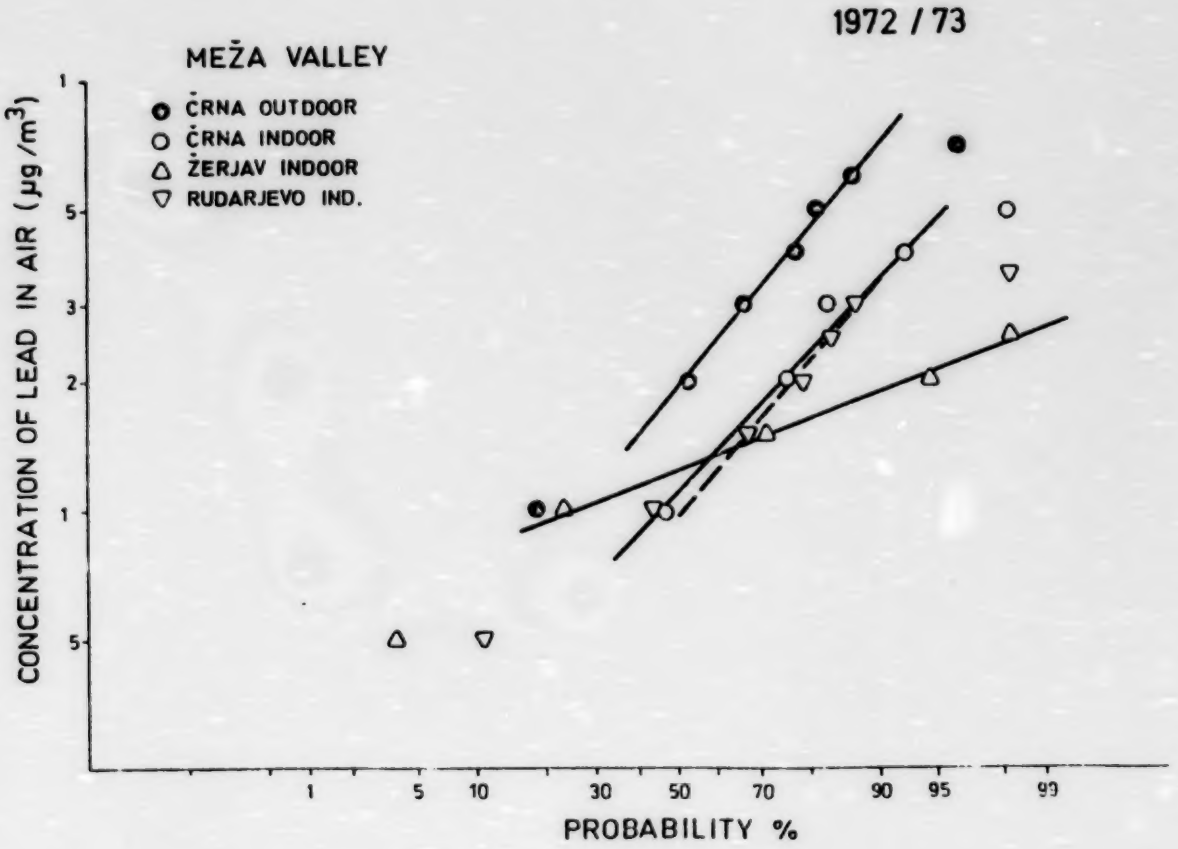

Figure A-5. Cumulative frequency distribution of lead in air for Meza Valley.

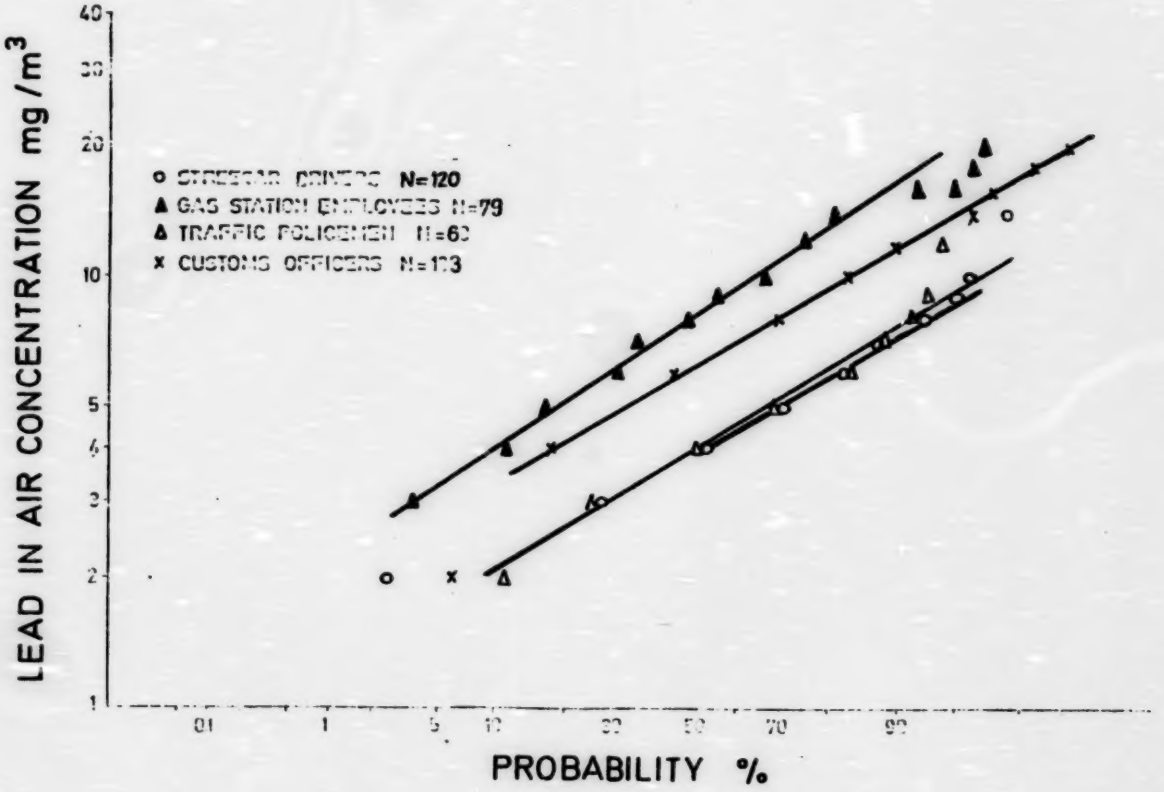

Figure A-6. Exposure to lead in air of some specific population groups.

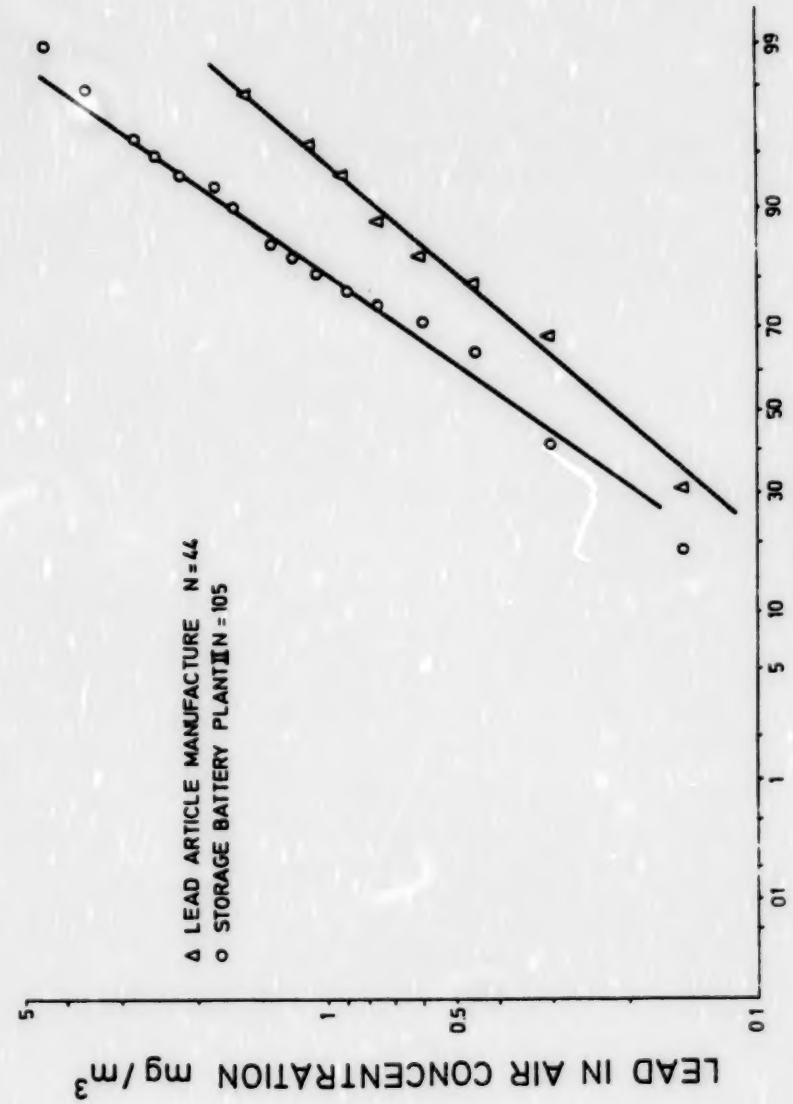

Figure A-7. Occupational exposure to lead in air.

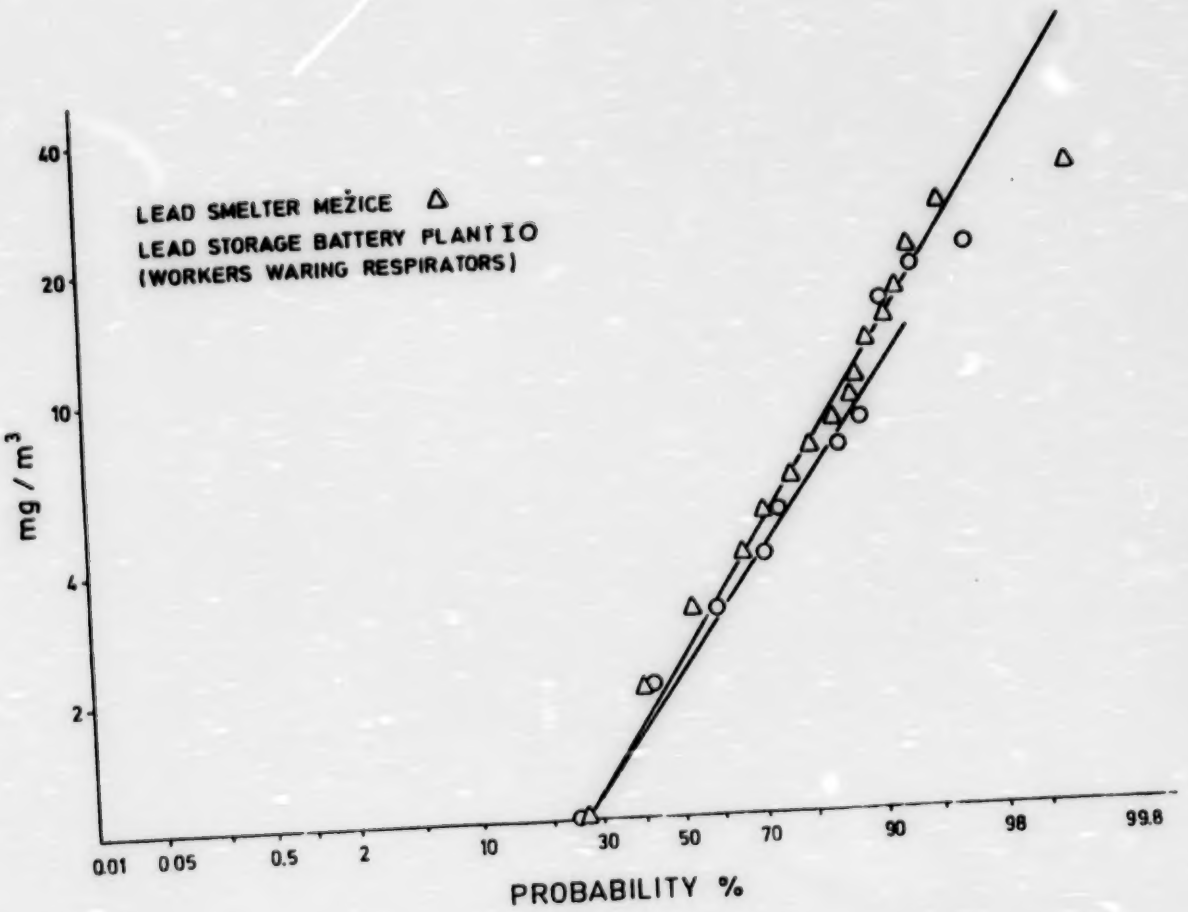

Figure A-8. Occupational exposure to lead in air, cumulative frequency distribution.

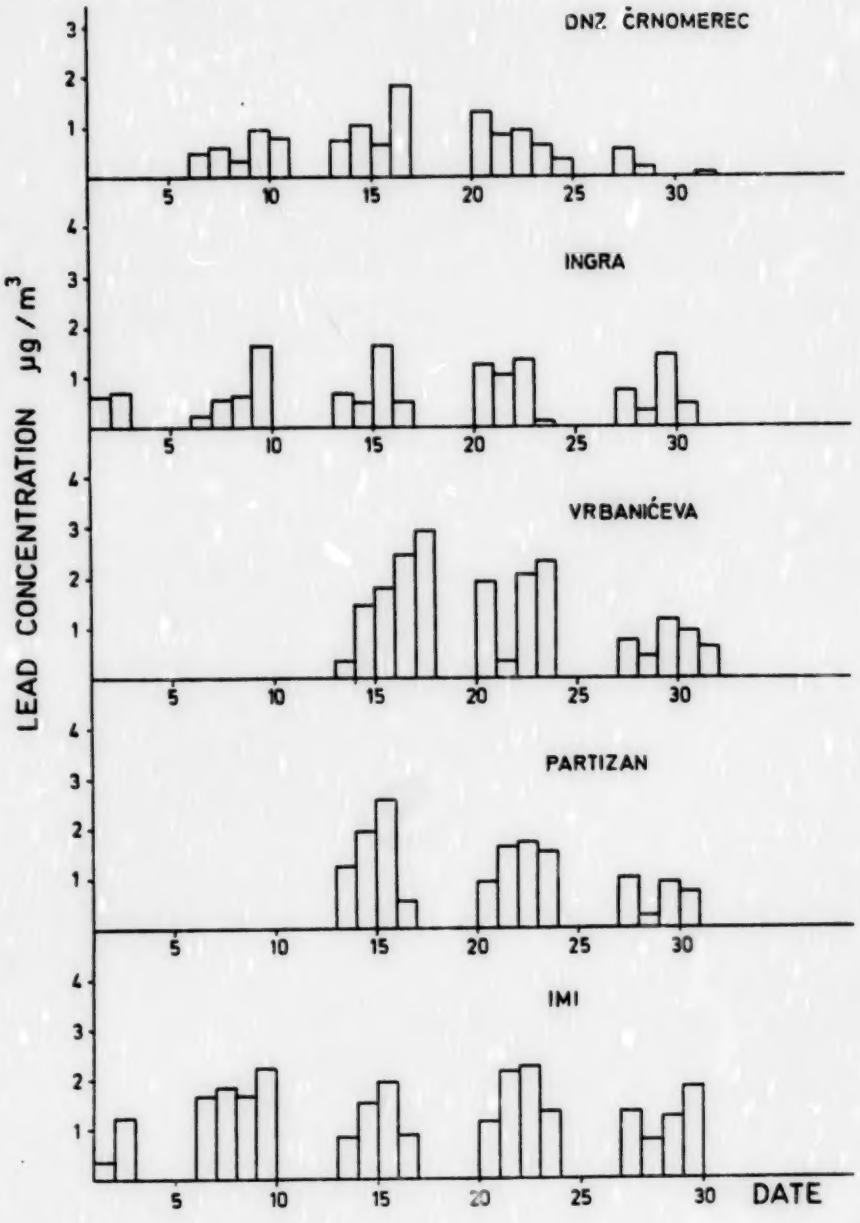

Figure A-9. Lead in air concentrations in Zagreb - March 1972.

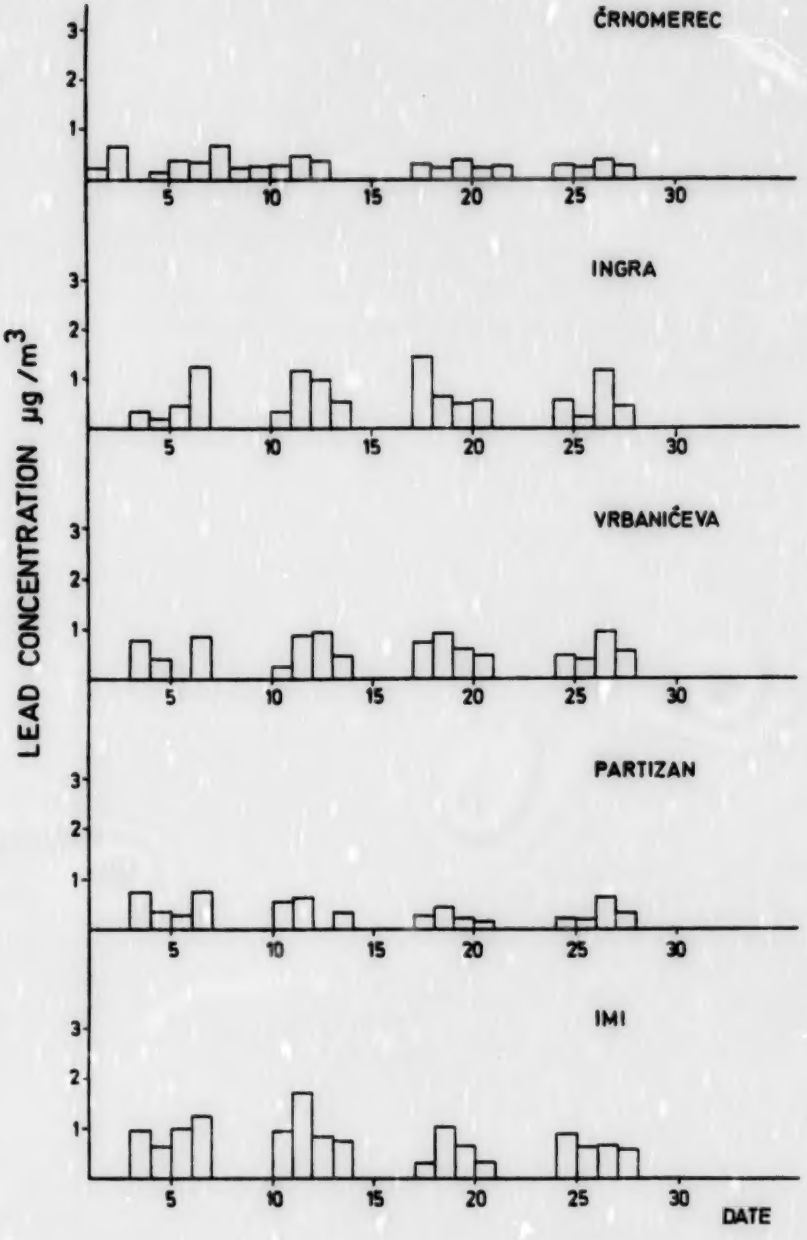

Figure A-10. Lead in air concentrations in Zagreb - April 1972.

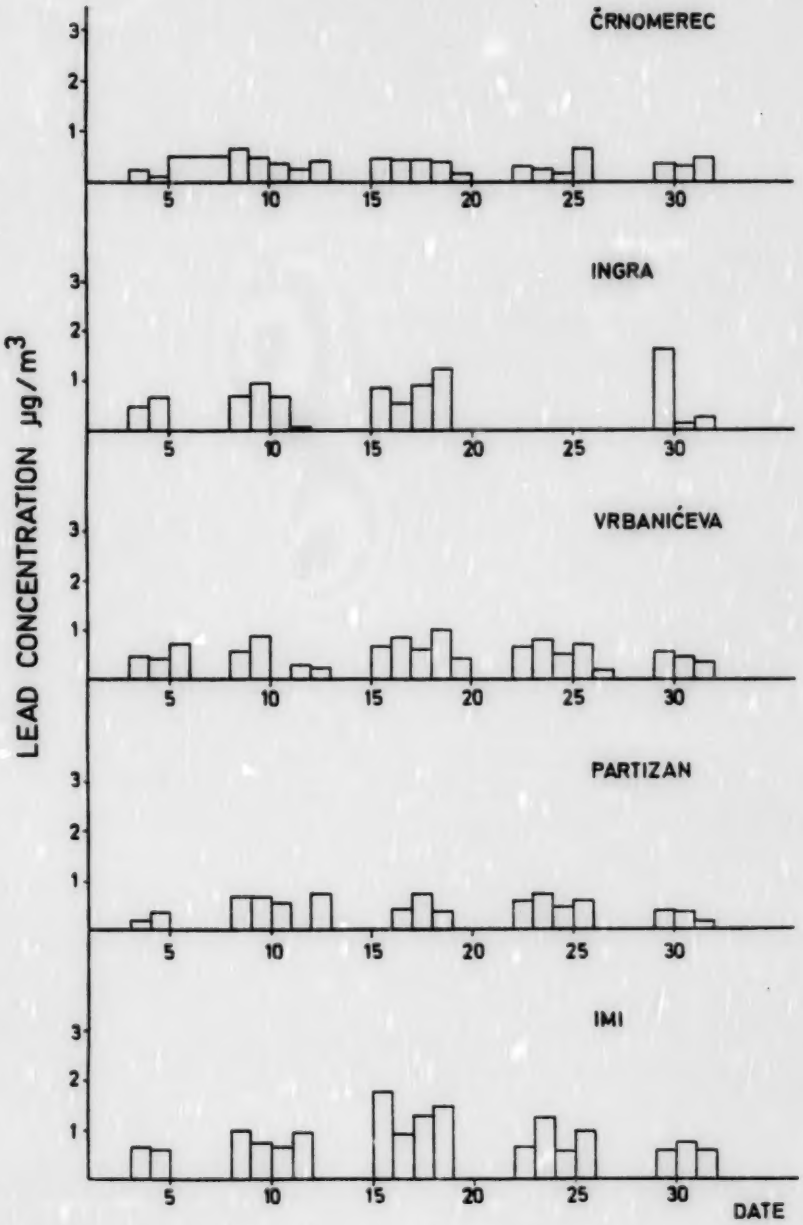

Figure A-11. Lead in air concentrations in Zagreb - May 1972.

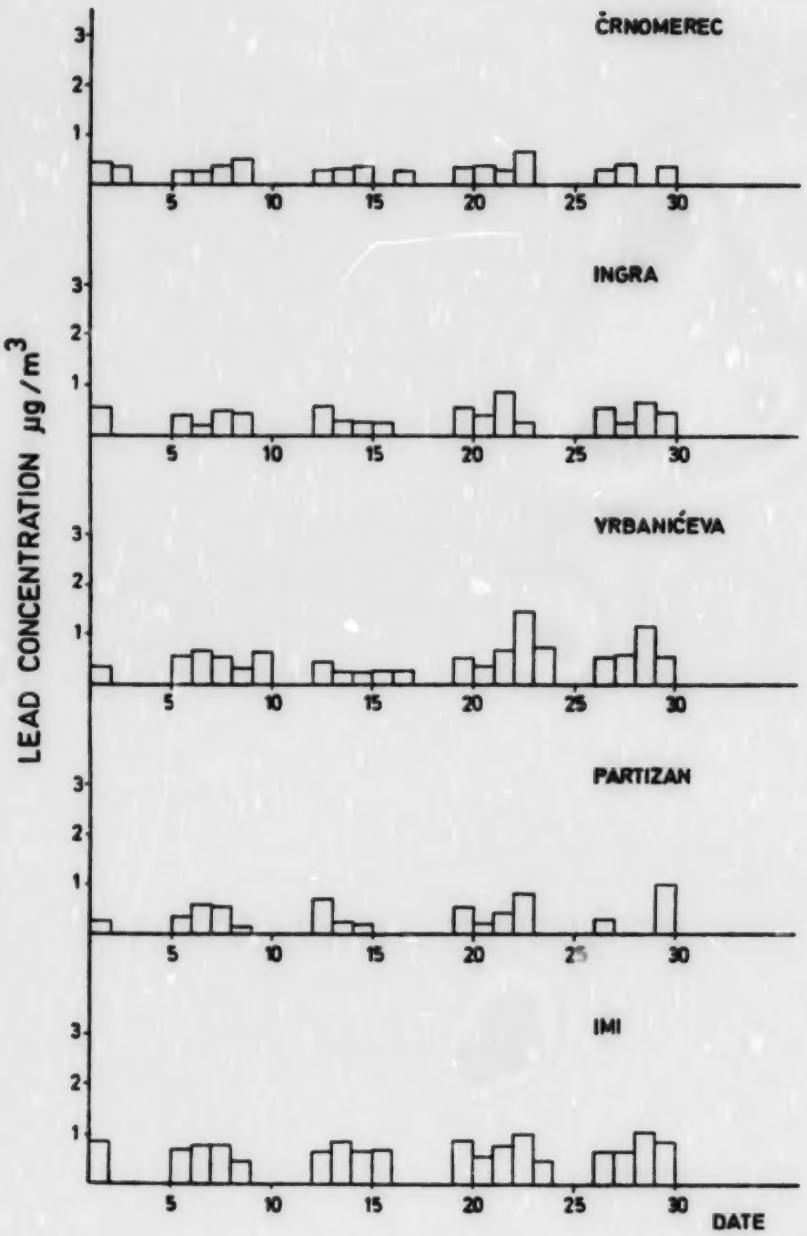

Figure A-12. Lead in air concentrations in Zagreb - June 1972.

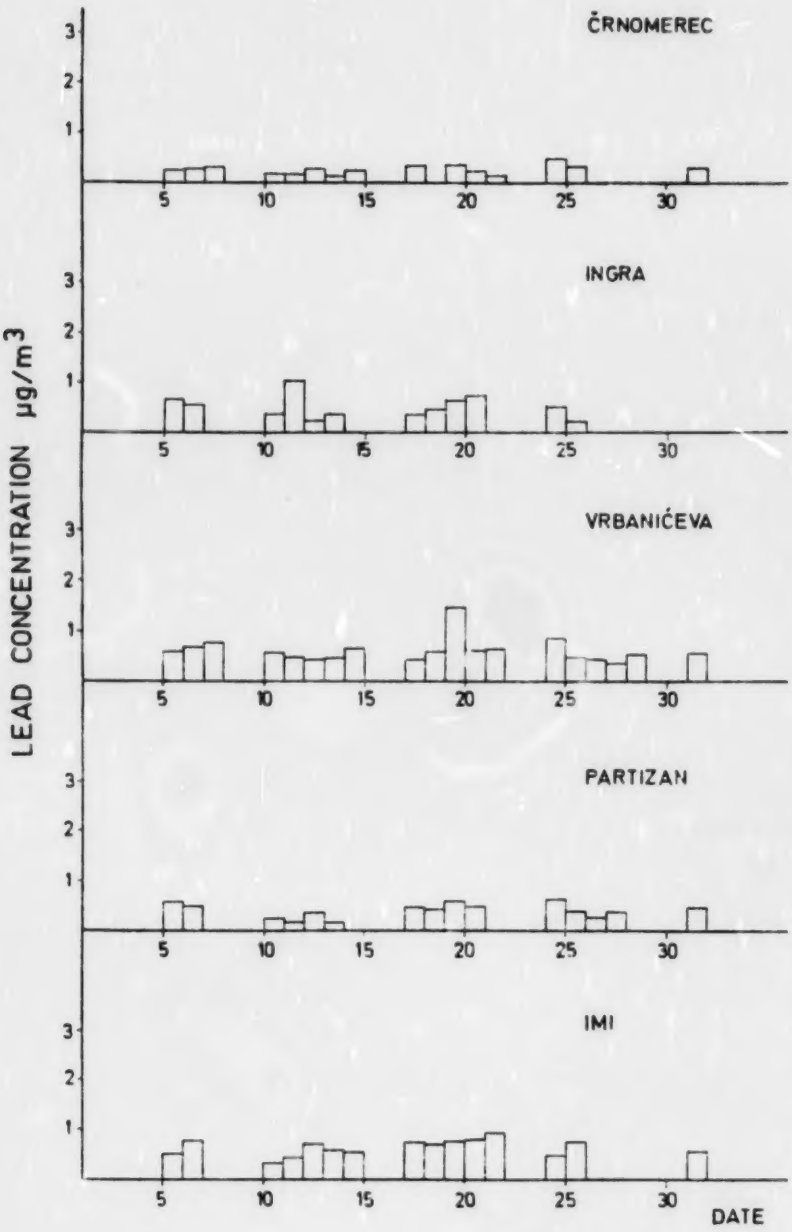

Figure A-13. Lead in air concentrations in Zagreb - July 1972.

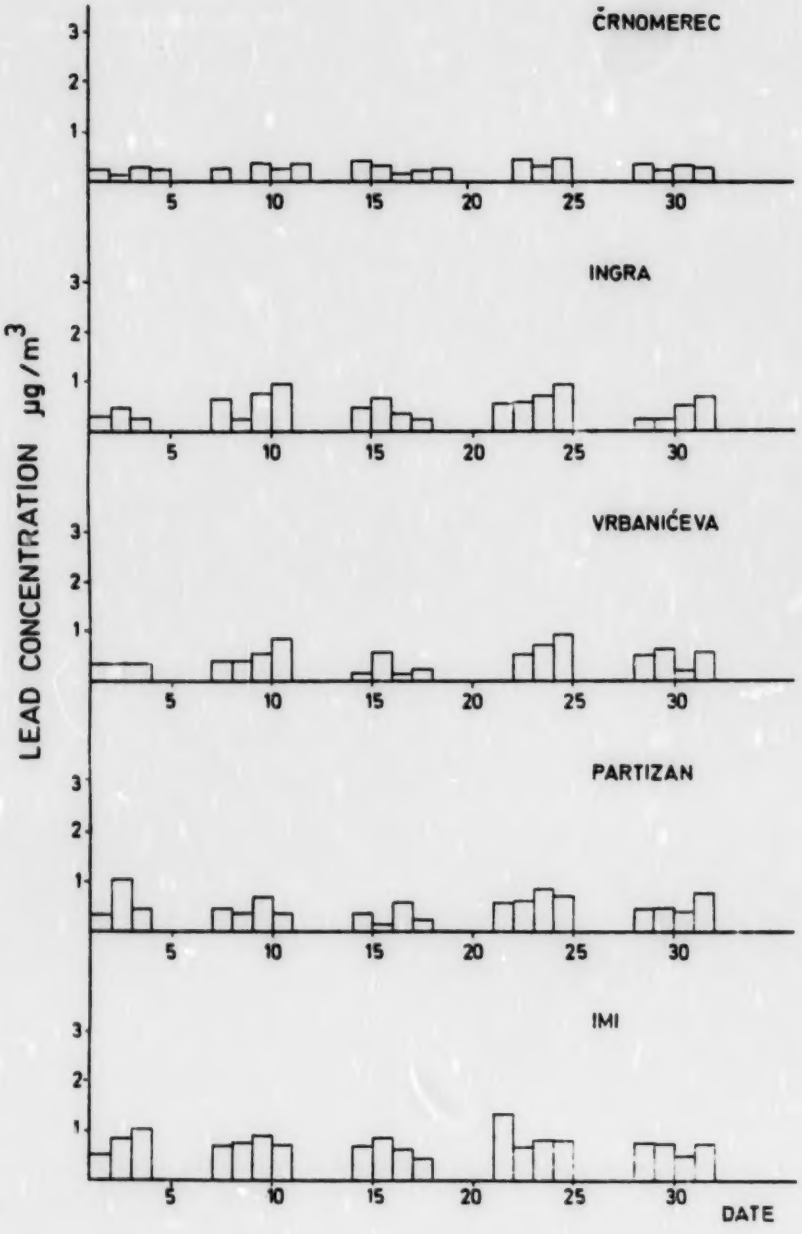

Figure A-14. Lead in air concentrations in Zagreb - August 1972.

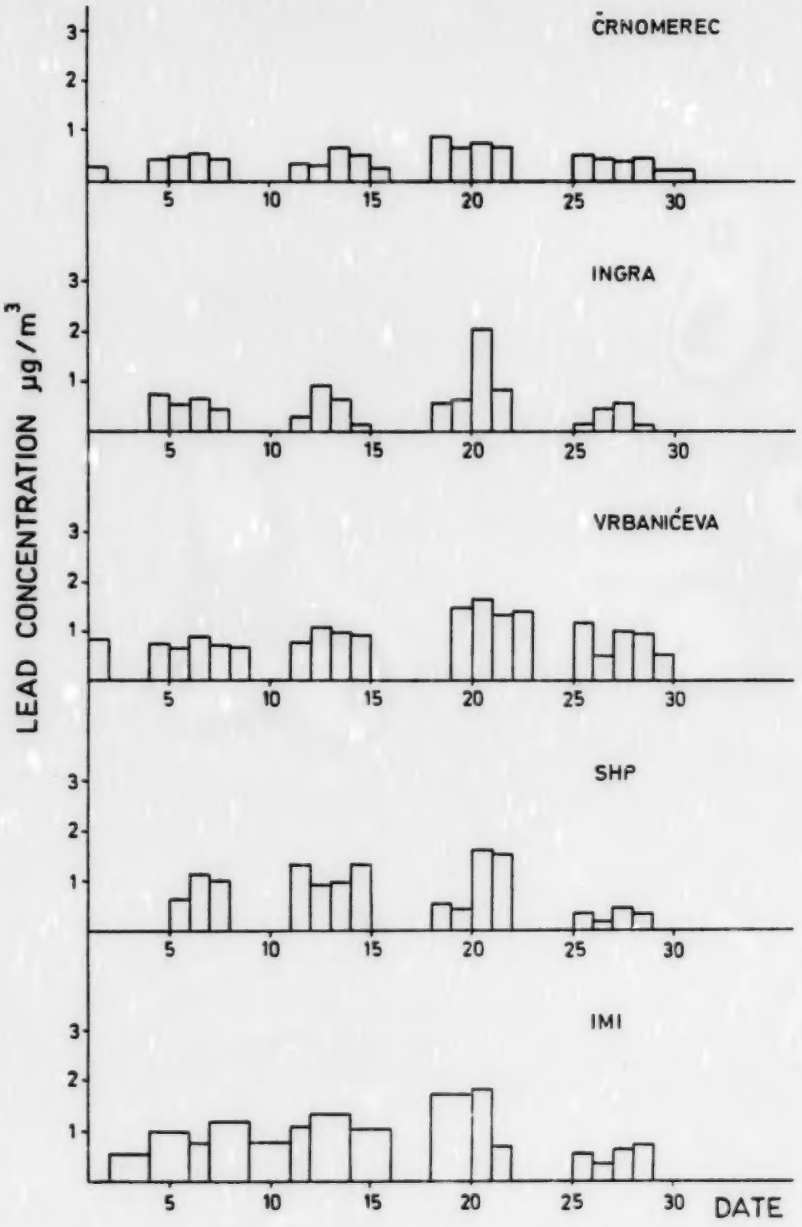

Figure A-15. Lead in air concentrations in Zagreb - September 1972.

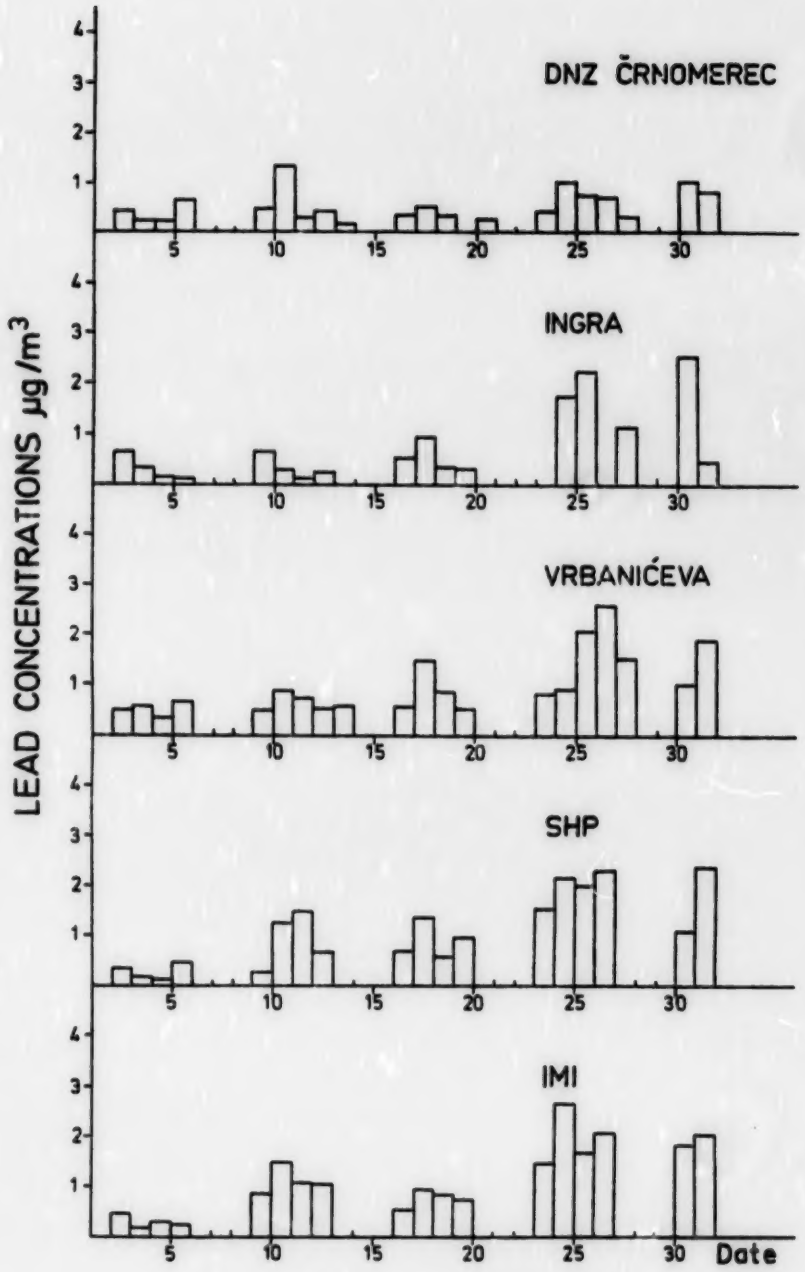

Figure A-16. Lead in air concentrations in Zagreb - October 1972.

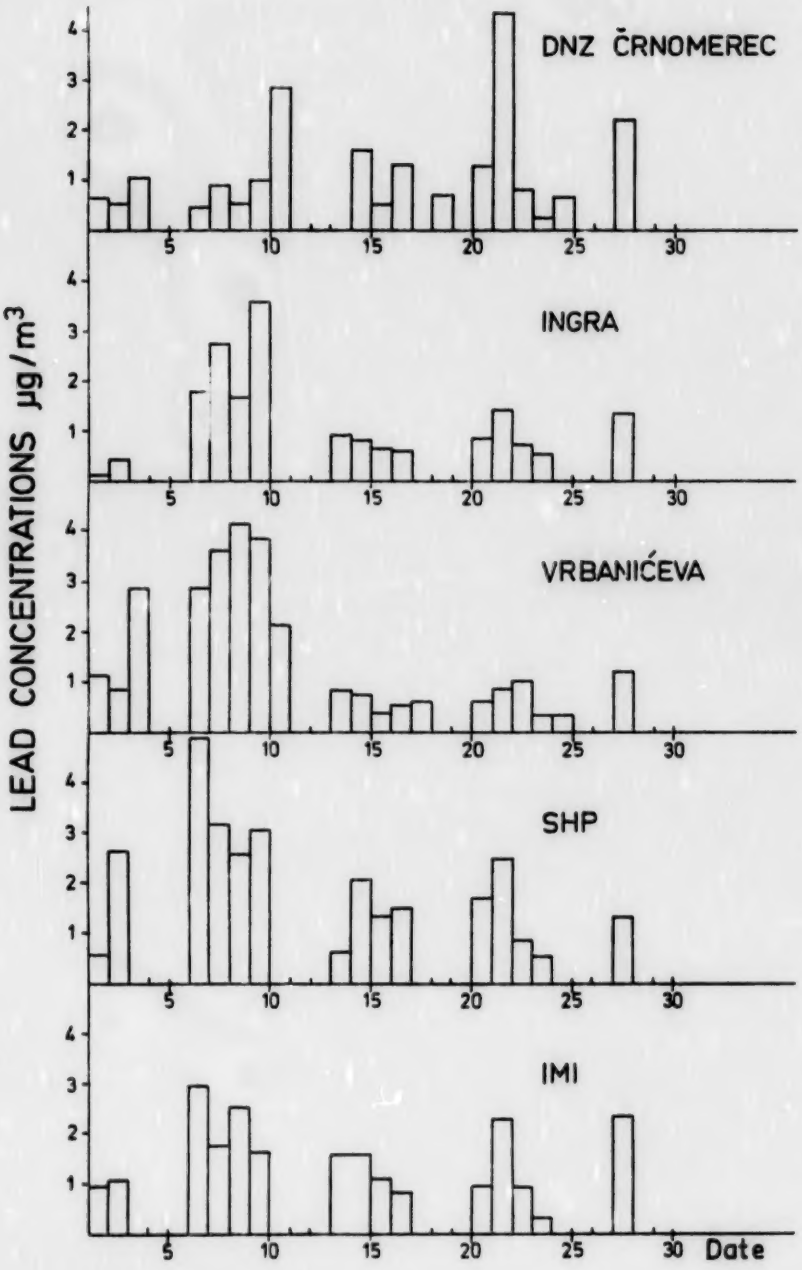

Figure A-17. Lead in air concentrations in Zagreb - November 1972.

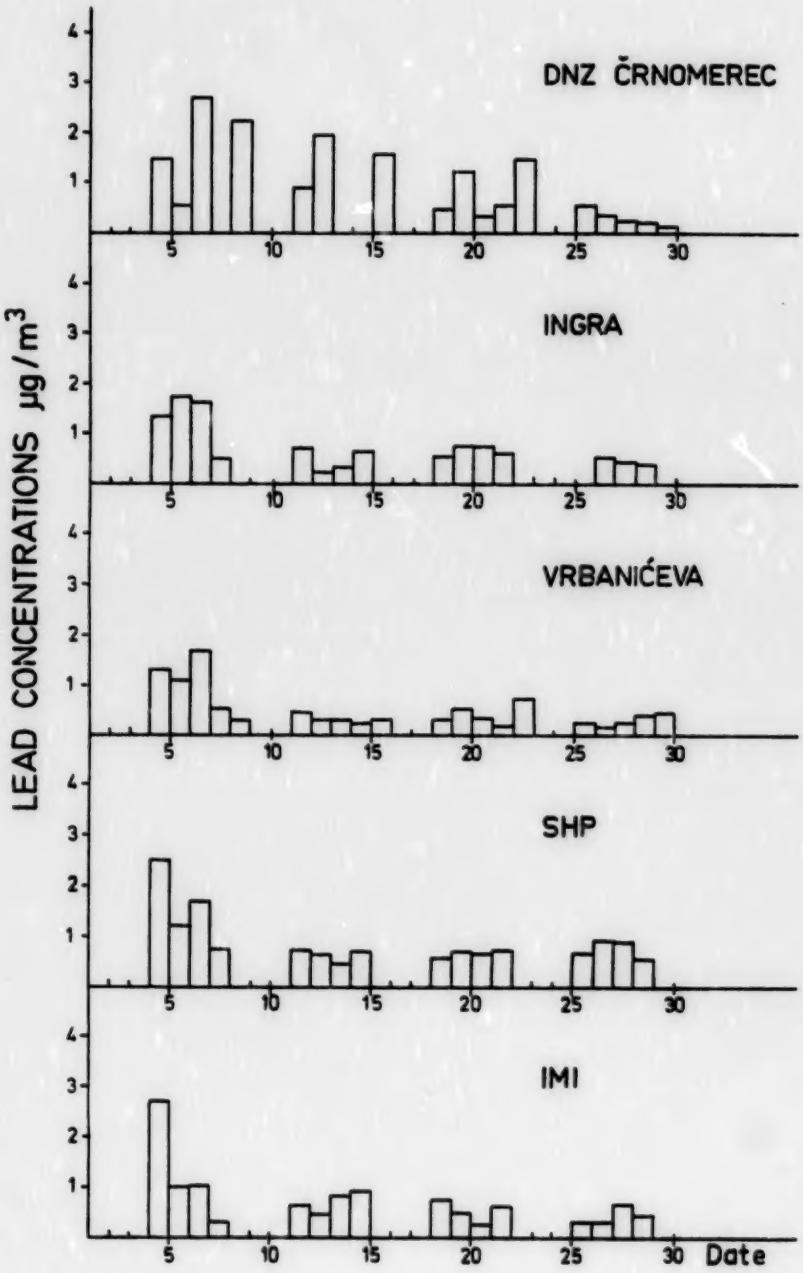

Figure A-18. Lead in air concentrations in Zagreb - December 1972.

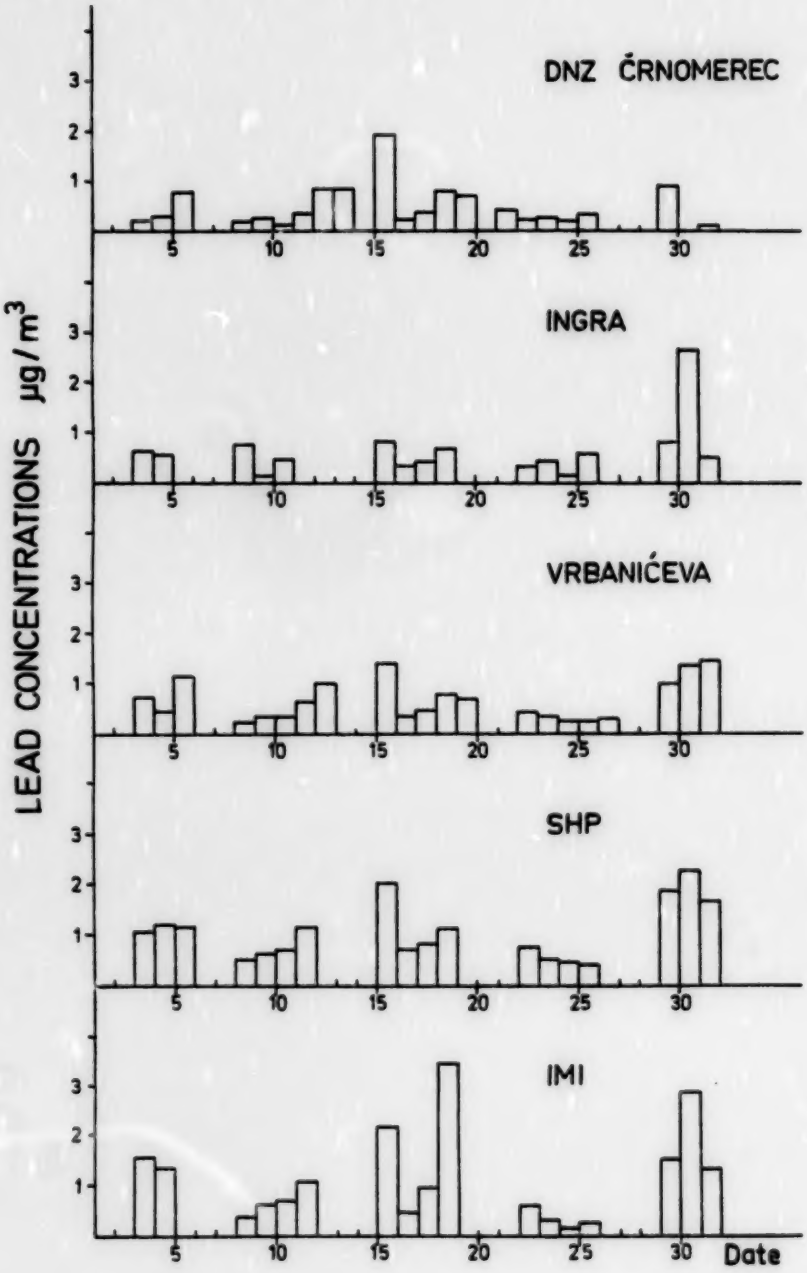

Figure A-19. Lead in air concentrations in Zagreb - January 1973

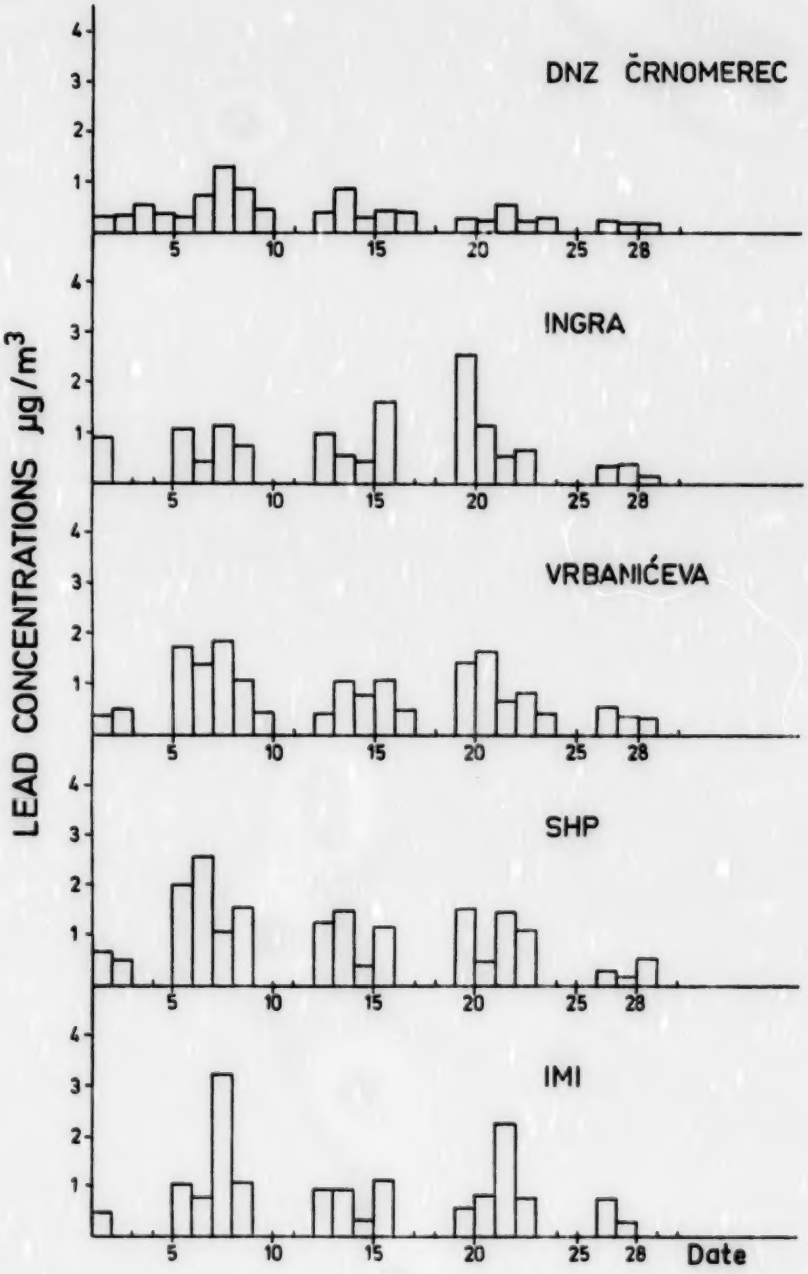

Figure A-20. Lead in air concentrations in Zagreb - February 1973

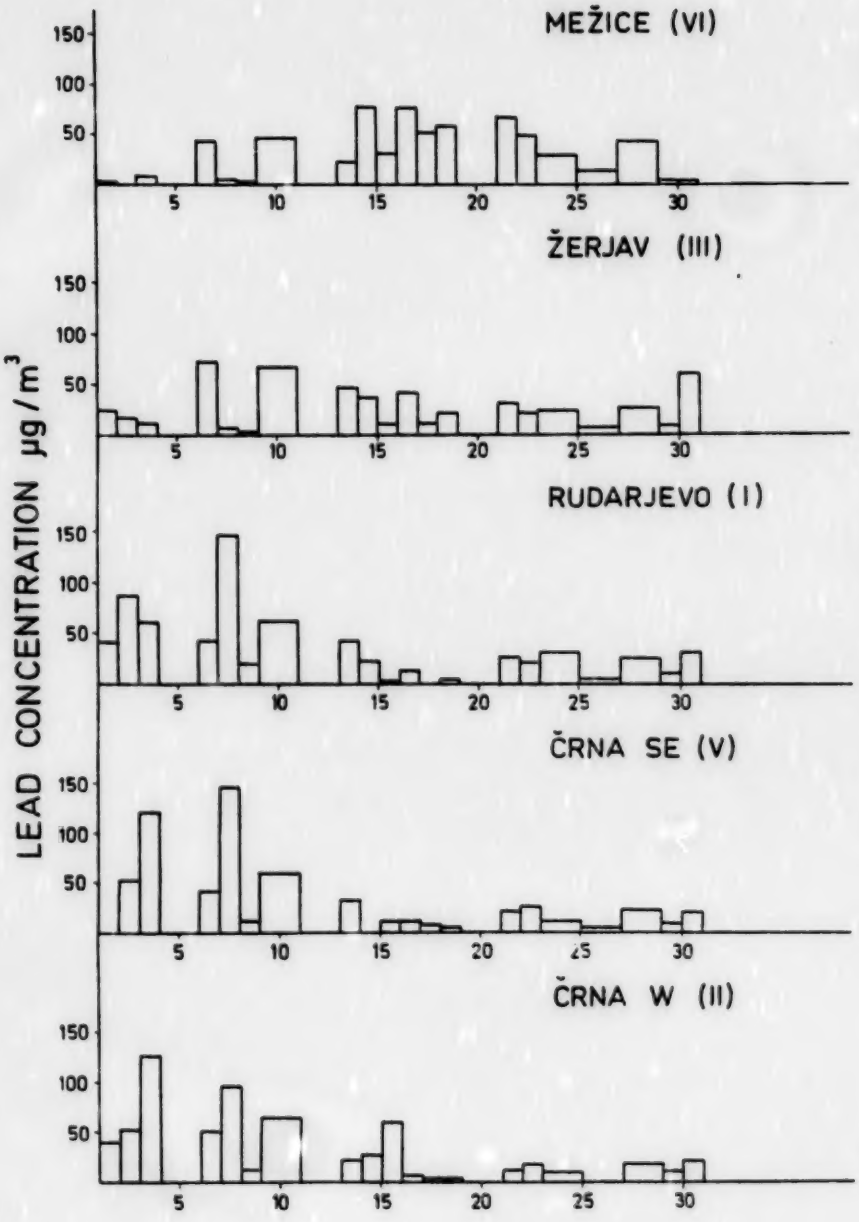

Figure A-21. Lead in air concentrations in Meza Valley - December 1971.

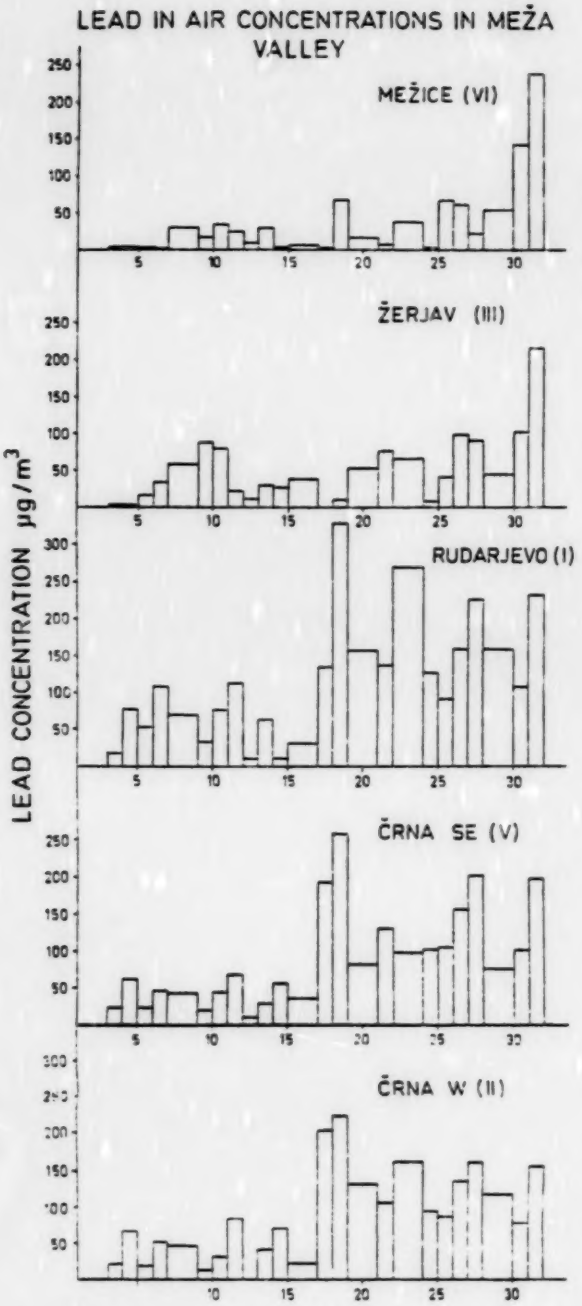

Figure A-22. Lead in air concentrations in Meza Valley - January 1972.

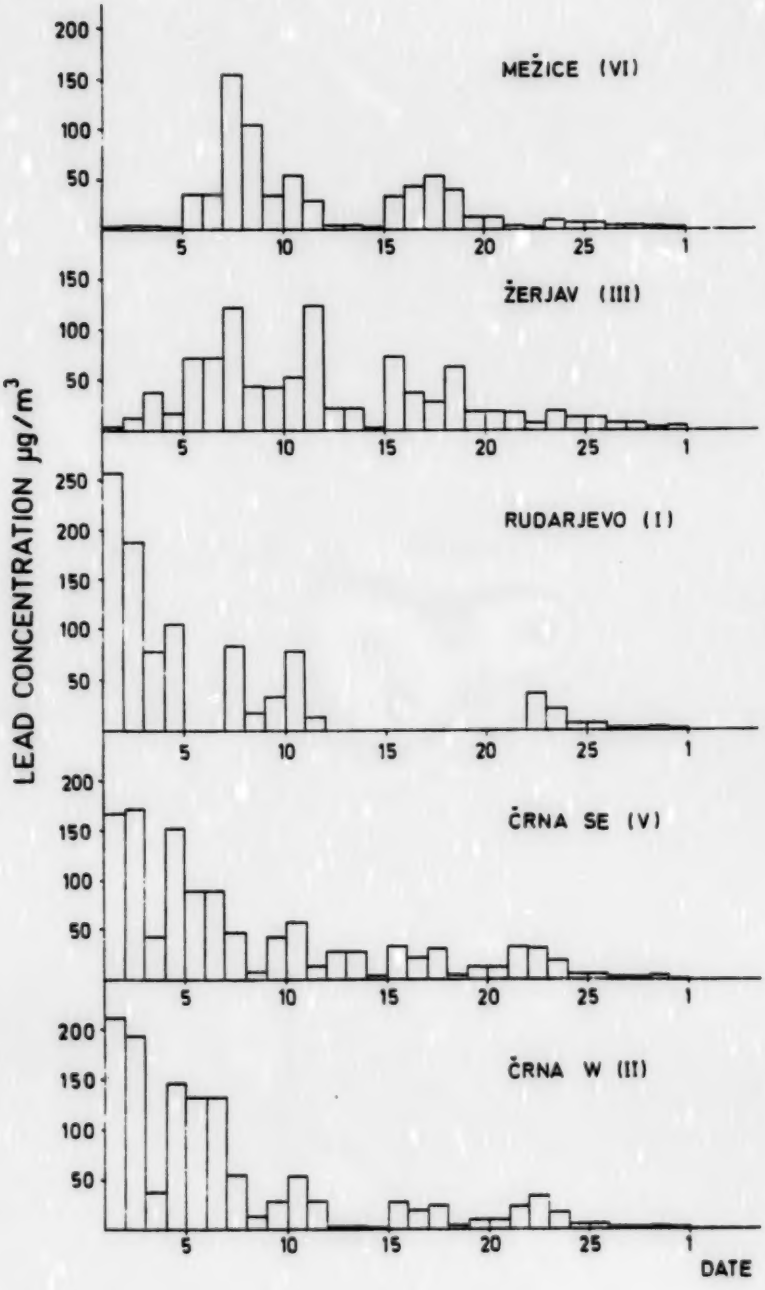

Figure A-23. Lead in air concentrations in Meza Valley - February 1972.

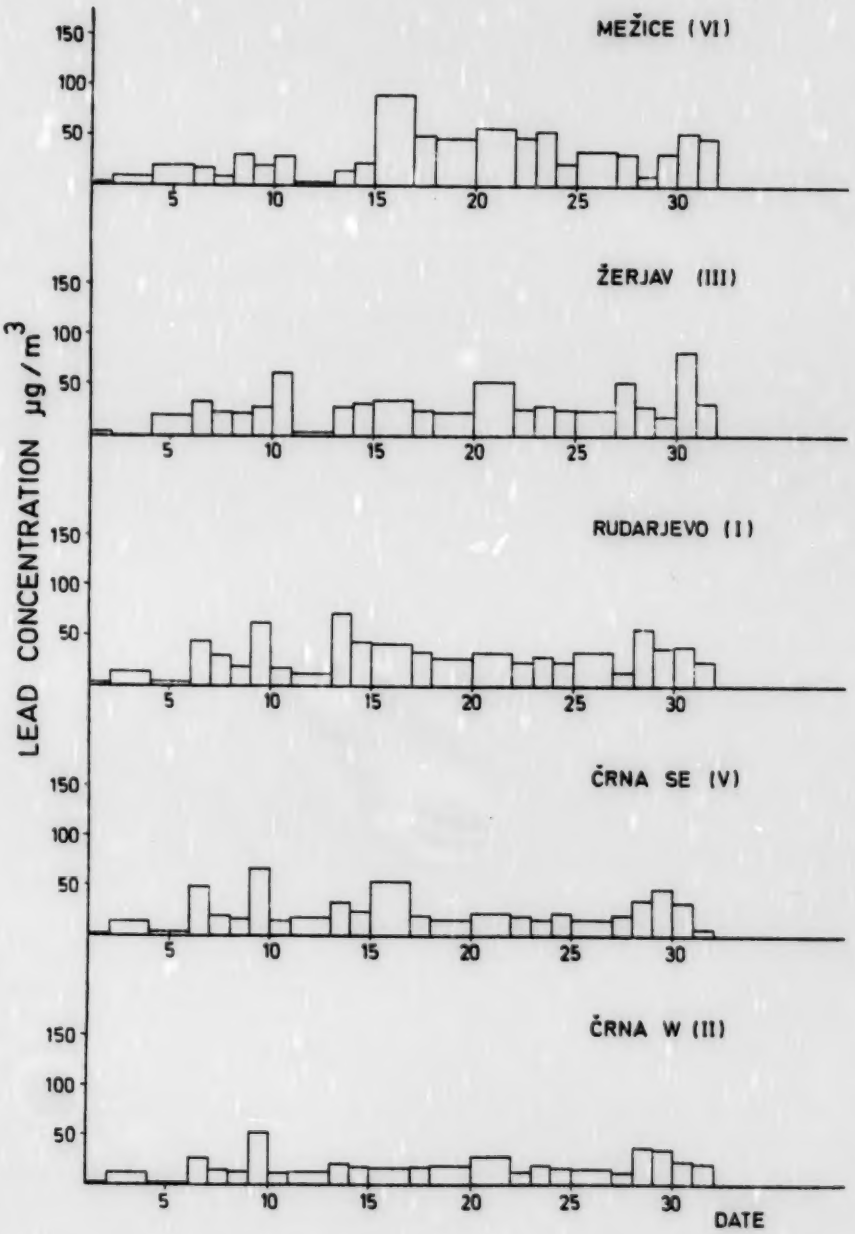

Figure A-24. Lead in air concentrations in Meza Valley - March 1972.

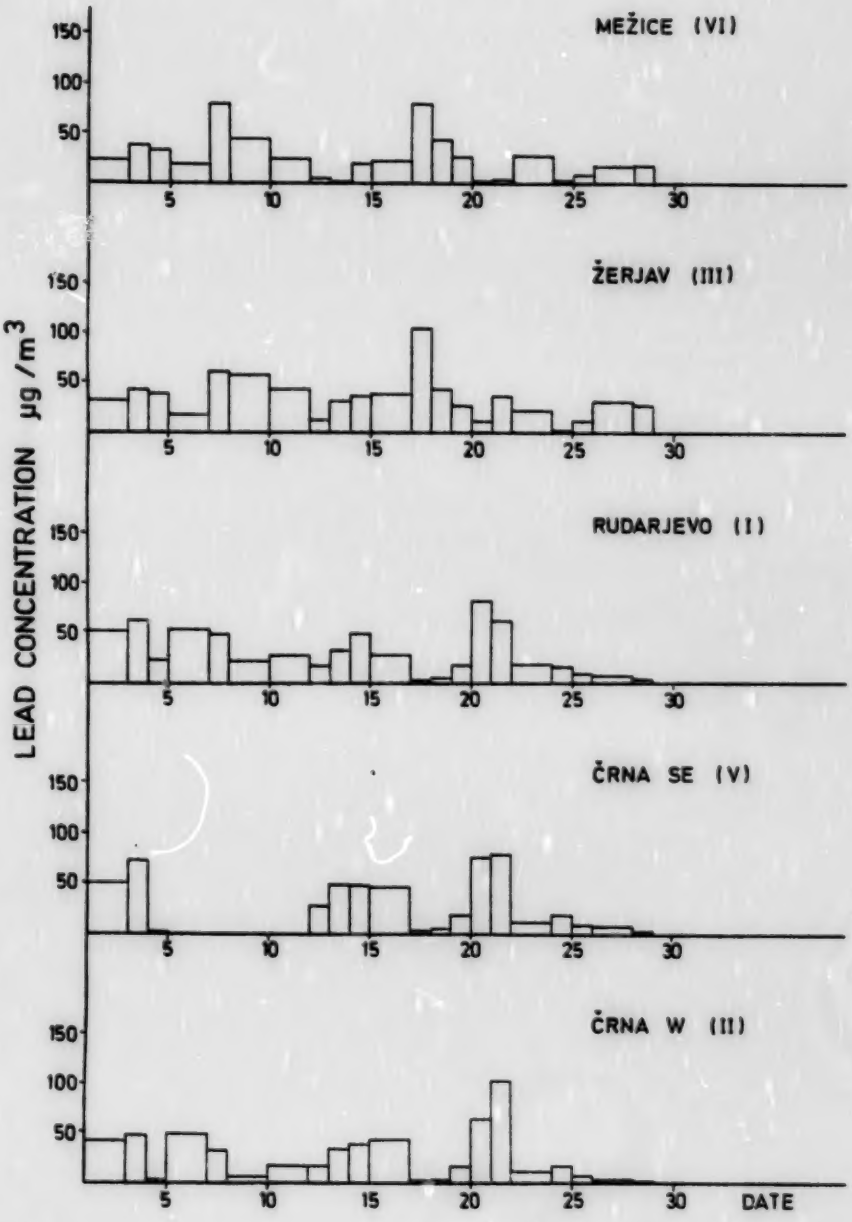

Figure A-25. Lead in air concentrations in Meza Valley - April 1972.

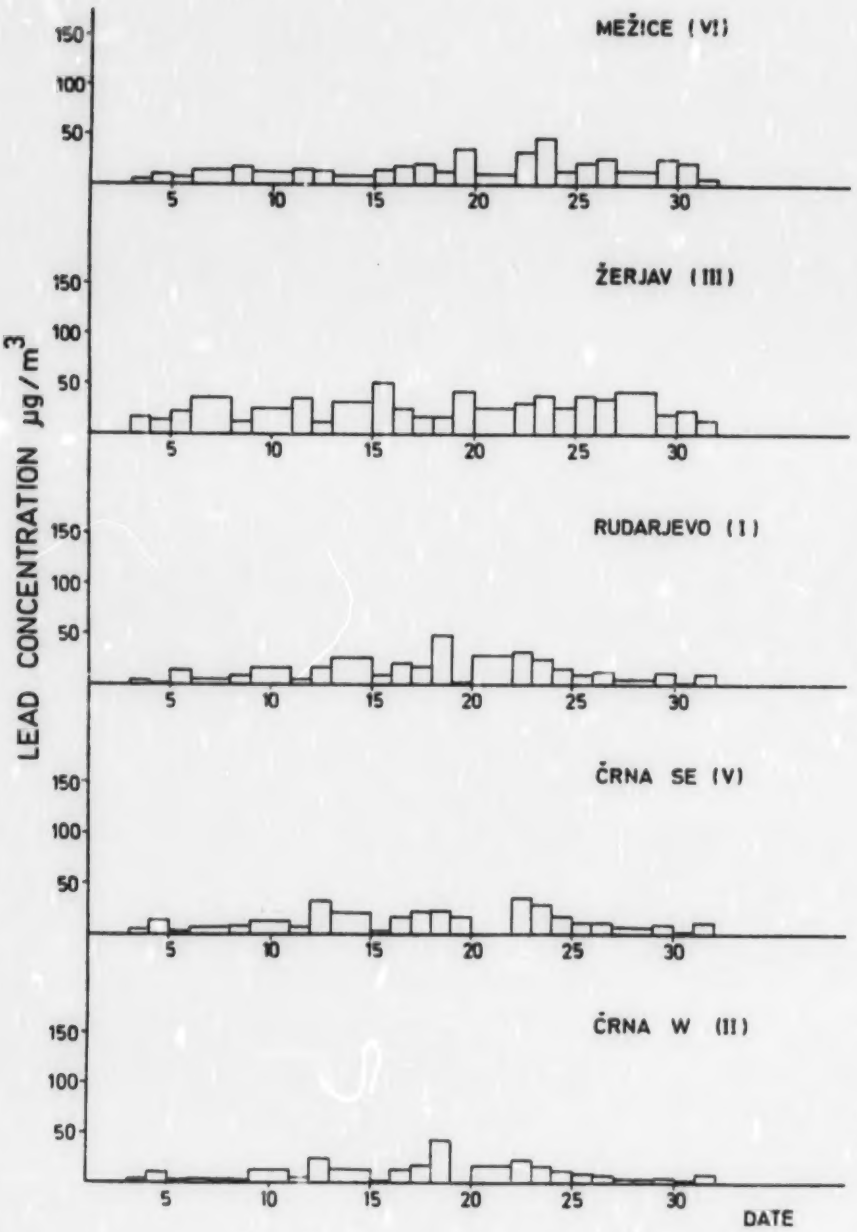

Figure A-26. Lead in air concentrations in Meza Valley - May 1972.

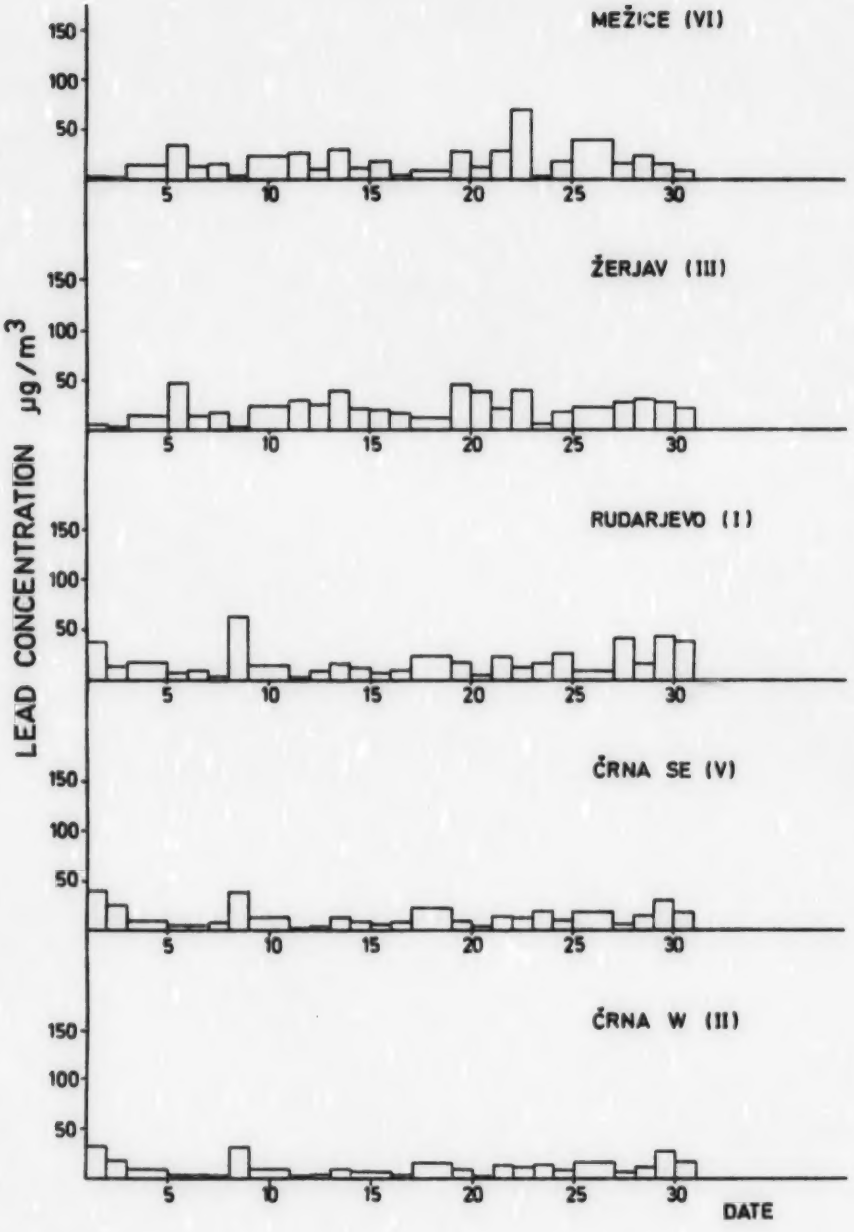

Figure A-27. Lead in air concentrations in Meza Valley - June 1972.

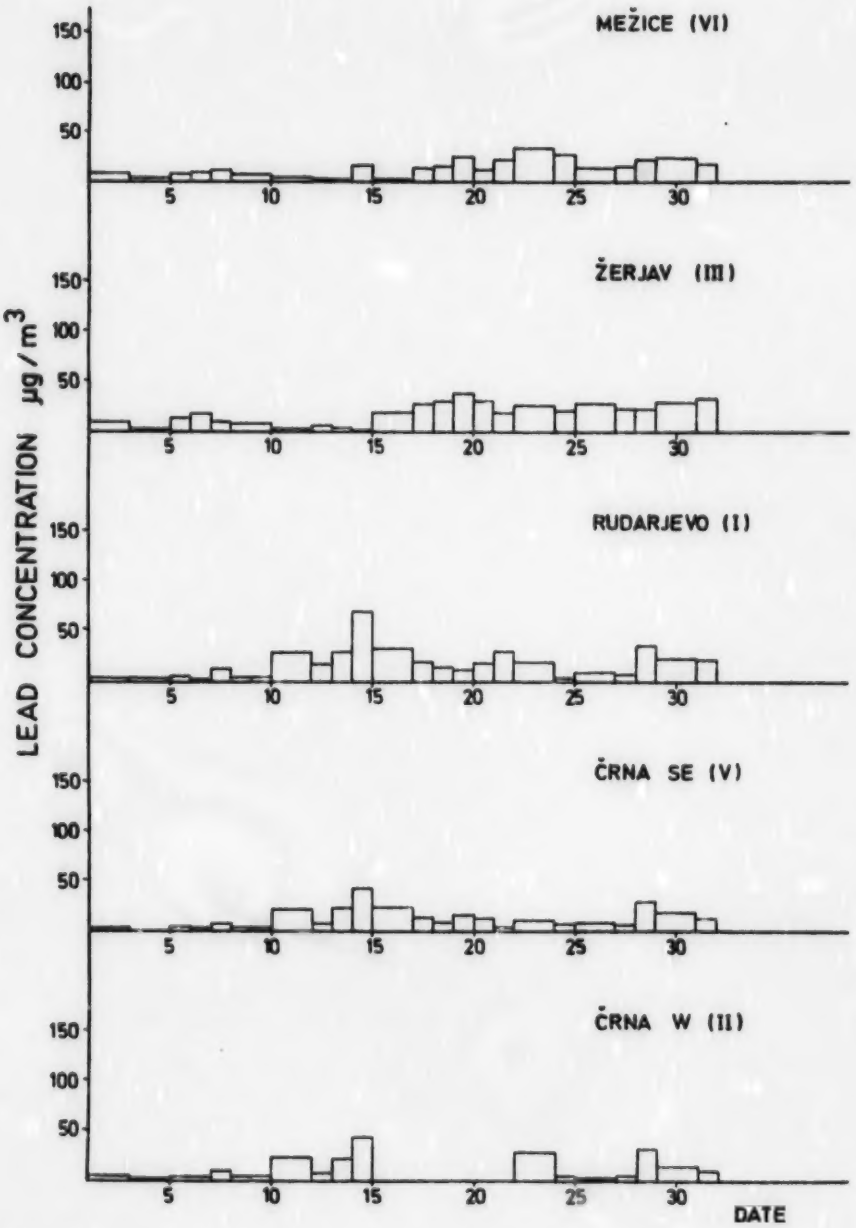

Figure A-28. Lead in air concentrations in Meza Valley - July 1972.

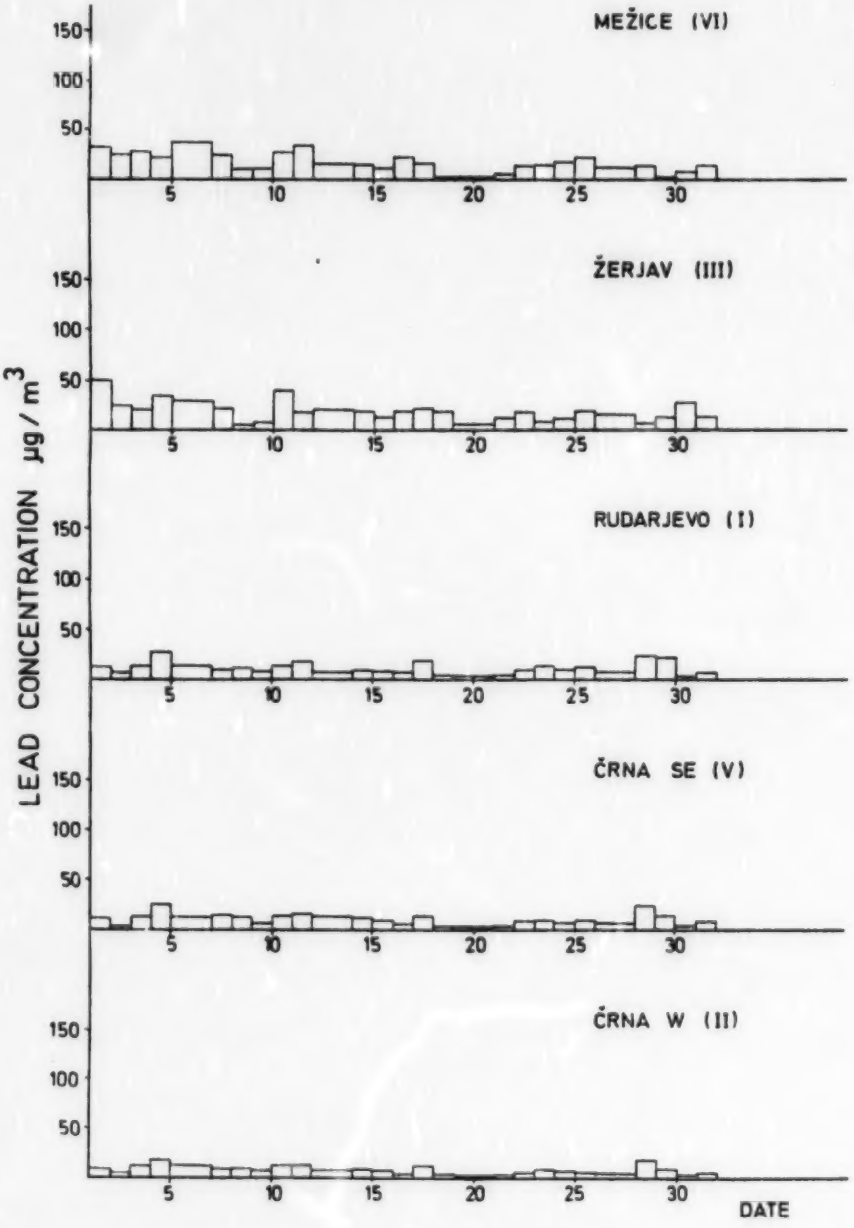

Figure A-29. Lead in air concentrations in Meza Valley - August 1972.

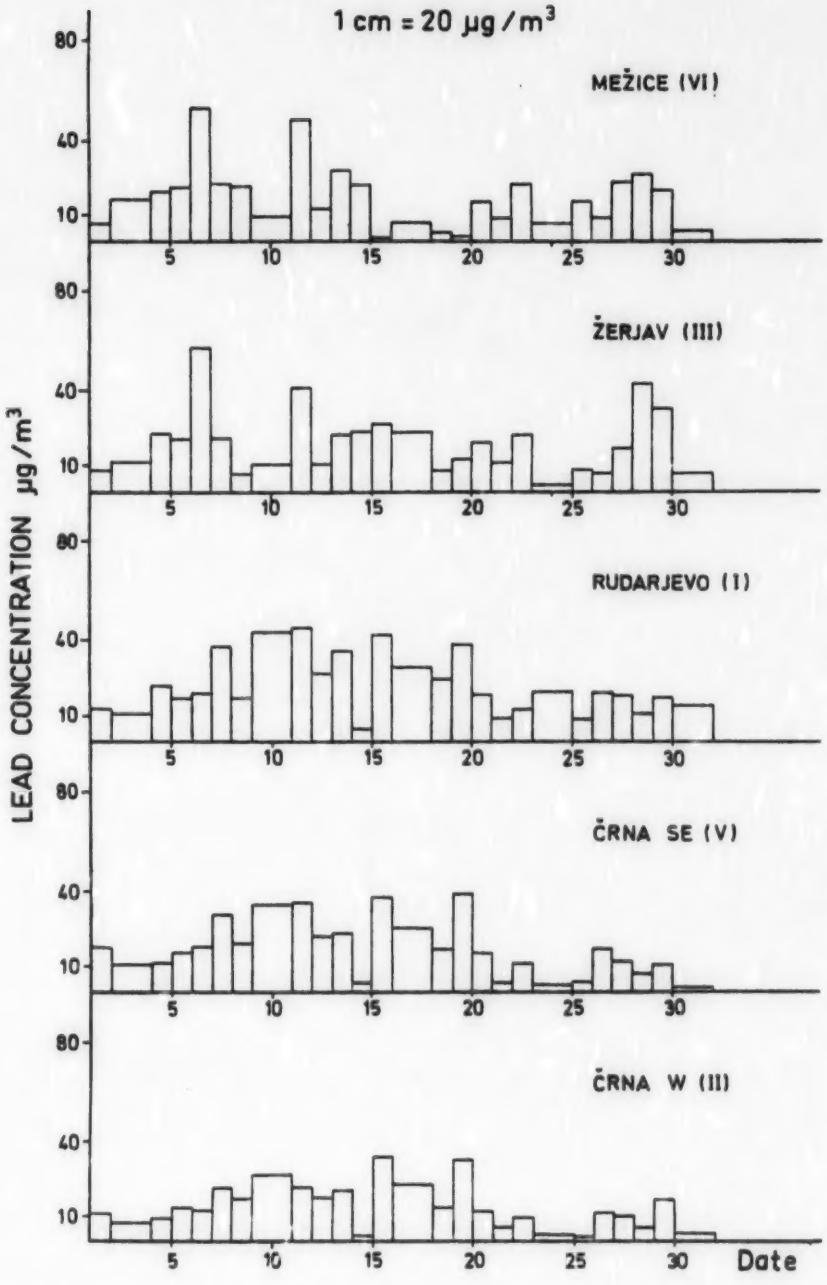

Figure A-30. Lead in air concentrations in Meza Valley - September 1972.

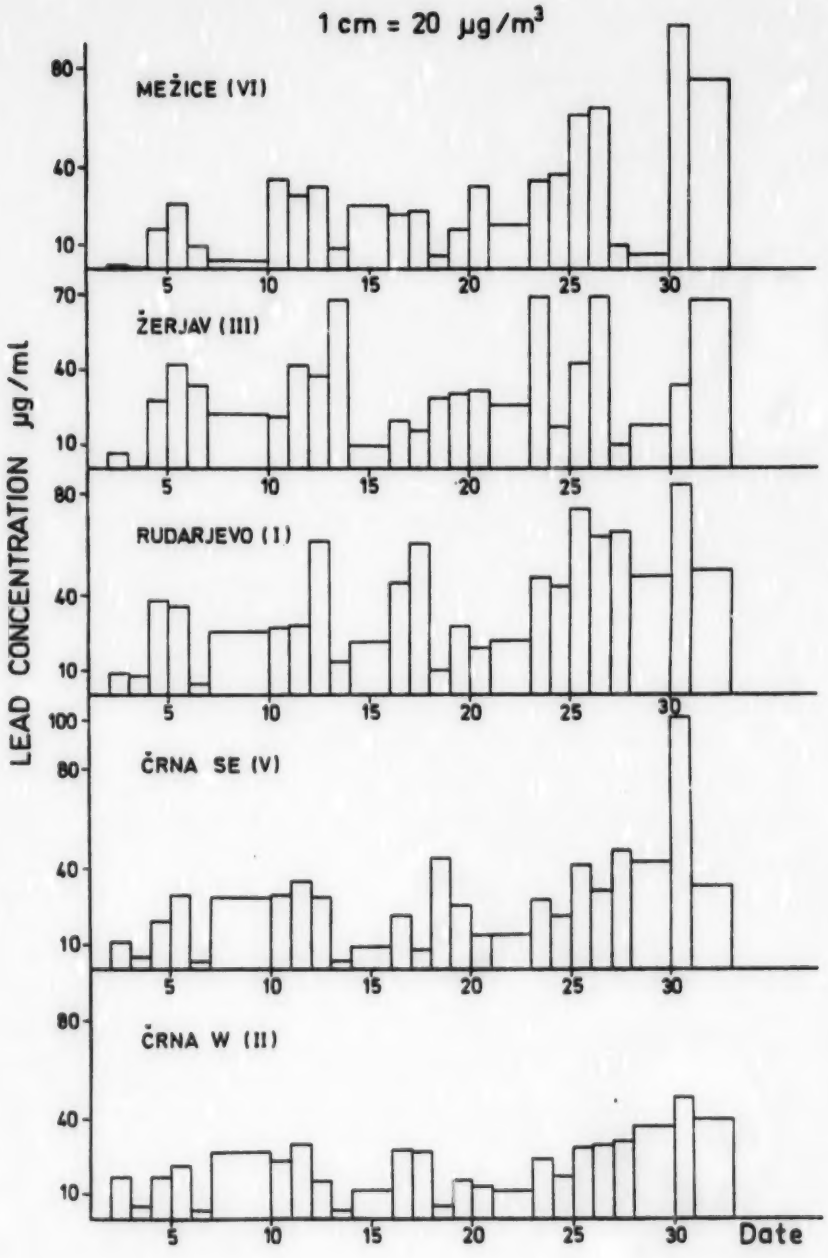

Figure A-31. Lead in air concentrations in Meza Valley - October 1972.

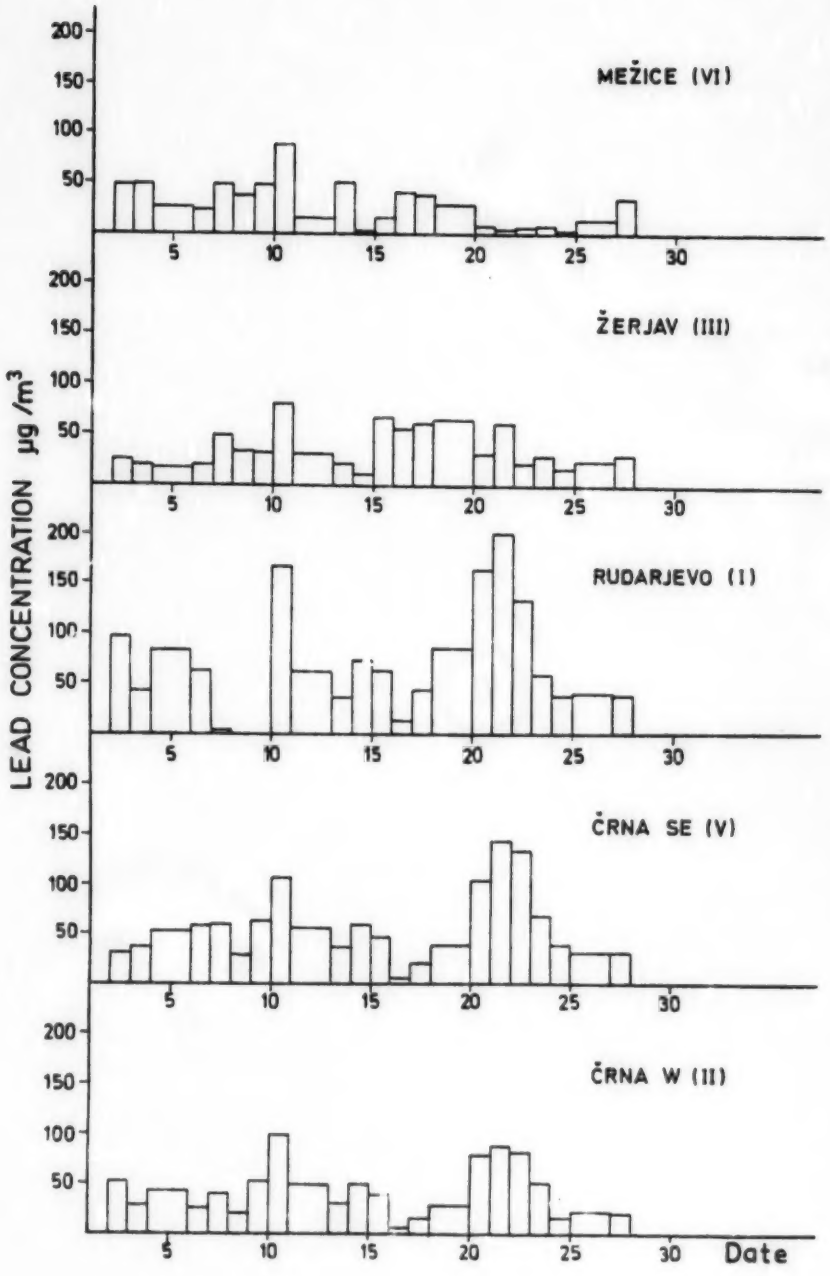

Figure A-32. Lead in air concentrations in Meza Valley - November 1972.

TABLE A-1. SUMMARY OF DATA FOR LEAD IN AIR* FOR RURAL AREA

Monthly Arithmetic Means Based on Weekly Averages			
Site / Month	Tolmin	Bovec	Bohinjska Bela
July	0.128	0.074	0.053
August	0.110	0.088	0.078
September	0.131	0.091	0.072
October	0.182	0.103	0.117
November	0.207	0.122	0.154
December	0.248	0.127	0.143
January	0.182	0.154	0.106
February	0.176	0.130	0.094
March	0.172	0.113	0.081
April	0.095	0.053	0.052
May	0.043	0.047	0.019
June	0.050	0.013	0.002
Yearly Average	0.146	0.094	0.079
Highest Weekly Average	0.301	0.220	0.209

* $\mu g/m^3$ - July 1972 - June 1973

TABLE A-2. SUMMARY OF DATA FOR LEAD IN AIR FOR ZAGREB*

Sampling Site: SHP

Month	Concentration of lead in air $\mu g/m^3$		Total number of results	No. of results above $\mu g/m^3$	
	Arithmetic mean	Highest value		0.7	2.0
September	0.97	1.61	15	8	4
October	1.09	2.37	18	10	7
November	1.95	4.97	15	12	1
December	0.91	2.52	16	9	2
January	1.06	2.03	18	12	1
February	1.07	2.57	17	10	
March	0.53	1.16	17	5	
April	0.45	0.90	16	2	
May	0.51	0.81	18	2	
June	0.63	1.02	17	6	
July	0.57	0.81	16	5	
August	0.56	1.36	19	2	
Annual Values	0.84	4.97	202	83	15
Geometric Means	0.67				
Standard Geometric Deviation	1.97				
95% Results Up To	2.08				

* 5 September 1972 - 31 August 1973

TABLE A-3. SUMMARY OF DATA FOR LEAD IN AIR FOR ZAGREB*

Sampling Site: Ingra

Month	Concentration of lead in air $\mu g/m^3$		Total number of results	No. of results above $\mu g/m^3$	
	Arithmetic mean	Highest value		0.7	2.0
March	0.81	1.62	18	8	
April	0.68	1.48	16	4	
May	0.72	1.63	13	5	
June	0.43	0.84	17	1	
July	0.50	1.02	12	2	
August	0.51	0.92	19	4	
September	0.60	2.04	16	4	1
October	0.75	2.57	17	5	2
November	1.21	3.55	15	10	2
December	0.75	1.73	15	5	
January	0.65	2.68	16	4	1
February	0.86	2.58	16	8	1
Annual Values	0.70	3.55	190	60	7
Geometric Mean	0.53				
Standard Geometric Deviation	2.04				
95% Results Up To	1.75				

* 1 March 1972 - 28 February 1973

TABLE A-4. SUMMARY OF DATA FOR LEAD IN AIR FOR ZAGREB*

Sampling Site: CRNOMEREC

Month	Concentration of lead in air µg/m³		Total Number of results	No. of results above µg/m³	
	Arithmetic mean	Highest value		0.7	2.0
March	0.68	1.81	18	8	
April	0.33	0.68	20	-	
May	0.38	0.63	22	-	
June	0.36	0.65	17	-	
July	0.25	0.49	15	-	
August	0.28	0.45	21	-	
September	0.49	0.89	20	2	
October	0.55	1.35	20	6	
November	1.20	4.38	18	11	3
December	0.99	2.65	17	8	2
January	0.51	1.92	21	7	
February	0.44	1.30	22	7	
Annual Values	0.53	4.38	231	46	5
Geometric Mean	0.34				
Standard Geometric Deviation	2.35				
95% Results Up To	1.40				

* 1 March 1972 - 28 February 1973

TABLE A-5. SUMMARY OF DATA FOR LEAD IN AIR FOR ZABREB*

Sampling Site: VRBANIĆEVA

Month	Concentration of lead in air µg/m³		Total Number of results	No. of results above µg/m³	
	Arithmetic mean	Highest value		0.7	2.0
March	1.40	2.94	14	10	3
April	0.64	0.93	15	7	
May	0.57	1.00	20	5	
June	0.55	1.43	20	3	
July	0.61	1.49	19	3	
August	0.48	0.95	18	3	
September	0.95	1.61	18	13	
October	0.96	2.56	20	11	2
November	1.52	4.12	19	13	6
December	0.52	1.69	20	4	
January	0.67	1.46	21	9	
February	0.82	1.82	20	9	
Annual Values	0.80	4.12	224	90	11
Geometric Mean	0.61				
Standard Geometric Deviation	2.00				
95% Results Up To	1.93				

* 1 March 1972 - 28 February 1973

TABLE A-6. SUMMARY OF DATA FOR LEAD IN AIR FOR ZAGREB*

Sampling Site: IMI

Month	Concentration of lead in air $\mu g/m^3$		Total Number of results	No. of Results above $\mu g/m^3$	
	Arithmetic mean	Highest value		0.7	2.0
March	1.46	2.26	18	17	3
April	0.83	1.72	16	9	
May	0.89	1.74	17	10	
June	0.75	1.04	18	9	
July	0.65	0.95	15	7	
August	0.77	1.33	19	13	
September	0.99	1.82	22	16	
October	1.13	2.67	18	11	3
November	1.52	2.95	15	14	4
December	0.73	2.70	16	6	1
January	1.17	3.43	17	9	3
Feburary	1.03	3.23	15	11	2
Annual Values	0.99	3.43	206	132	16
Geometric Mean	0.85				
Standard Geometric Deviation	1.76				
95% Results Up To	2.17				

* 1 March 1972 - 28 February 1973

TABLE A-7. SUMMARY OF DATA FOR LEAD IN AIR FOR MEZA VALLEY*

Sampling Site: Mezice

Month	Concentration of lead in air $\mu g/m^3$		Total number of results	Number of results above $\mu g/m^3$			
	Arithmetic mean	Highest value		2	10	50	100
December	31	77	24	19	17	5	-
January	35	236	29	23	18	7	2
February	23	154	29	24	13	4	2
March	31	90	31	28	24	6	-
April	25	79	28	25	22	2	-
May	16	45	29	29	21	-	-
June	18	69	30	28	21	1	-
July	12	33	31	23	16	-	-
August	16	36	31	27	23	-	-
September	16	53	31	29	17	1	-
October	26	96	31	29	20	5	-
November	27	86	26	24	20	1	-
Annual values	23	236	350	308	232	32	4
Geometric mean	18.2						
Standard Geometric Deviation	2.0						
95% results up to	62.0						

* 1 December 1971 - 30 November 1972

TABLE A-8. SUMMARY OF DATA FOR LEAD IN AIR FOR MEZA VALLEY*

Sampling Site: Zerjav

Month	Concentration of lead in air µg/m³		Total number of results	Number of results above µg/m³			
	Arithmetic mean	Highest value		2	10	50	100
December	28	74	24	24	19	4	-
January	51	217	29	28	25	13	2
February	33	124	29	28	22	7	2
March	30	82	29	29	26	5	-
April	34	105	28	27	27	4	1
May	28	52	29	29	29	1	-
June	21	46	30	28	26	-	-
July	17	36	31	24	19	-	-
August	18	49	31	31	25	-	-
September	18	57	31	31	22	1	-
October	30	69	31	30	26	5	-
November	34	76	26	26	25	7	-
Annual values	28	217	348	335	291	47	5
Geometric mean	22.6						
Standard Geometric Deviation	1.9						
95% results up to	69						

* 1 December 1971 - 30 November 1972

Table A-9. SUMMARY OF DATA FOR LEAD IN AIR FOR MEZA VALLEY*

Sampling Site: Rudarjevo

Month	Concentration of lead in air µg/m³		Total number of results	Number of results above µg/m³			
	Arithmetic mean	Highest value		2	10	50	100
December	35	149	24	24	19	5	1
January	122	328	29	29	27	23	16
February	55	257	17	13	11	6	3
March	28	70	31	30	28	3	-
April	29	82	27	27	21	7	-
May	15	49	29	27	18	-	-
June	18	63	30	29	19	1	-
July	17	68	31	29	19	1	-
August	10	28	31	27	13	-	-
September	23	46	31	31	28	-	-
October	36	83	31	31	27	6	-
November	73	199	24	24	23	15	4
Annual values	37	328	335	321	253	67	24
Geometric mean	21.0						
Standard Geometric Deviation	2.9						
95% results up to	122						

* 1 December 1971 - 30 November 1972

TABLE A-10. SUMMARY OF DATA FOR LEAD IN AIR FOR MEZA VALLEY*

Sampling Site: Crna Se

Month	Concentration of lead in air $\mu g/m^3$		Total number of	Number of results above $\mu g/m^3$			
	Arithmetic mean	Highest value		2	10	50	100
December	34	147	24	24	18	5	2
January	102	259	29	28	28	18	9
February	40	171	29	25	20	6	3
March	23	67	31	28	27	3	-
April	35	79	21	19	14	5	-
May	14	35	27	26	16	-	-
June	13	39	30	28	16	-	-
July	11	42	31	24	15	-	-
August	9	25	31	27	15	-	-
September	17	38	31	29	23	-	-
October	27	100	31	31	25	1	1
November	55	144	26	26	25	13	4
Annual values	29	259	341	315	242	51	19
Geometric mean	17.4						
Standard Geometric Deviation	2.8						
95% results up to	96						

* 1 December 1971 - 30 November 1972

TABLE A-11. SUMMARY OF DATA FOR LEAD IN AIR FOR MEZA VALLEY*

Sampling Site: Crna W

Month	Concentration of lead in air $\mu g/m^3$		Total number of results	Number of results above $\mu g/m^3$			
	Arithmetic mean	Highest value		2	10	50	100
December	32	128	24	22	19	7	1
January	90	222	29	28	28	19	12
February	38	211	29	24	17	7	3
March	18	54	31	28	28	1	-
April	26	102	28	25	19	2	1
May	10	42	29	26	13	-	-
June	11	33	30	28	13	-	-
July	11	41	24	18	9	-	-
August	7	18	31	27	8	-	-
September	14	34	31	29	18	-	-
October	22	48	31	31	27	-	-
November	42	99	26	26	25	8	-
Annual values	26	222	343	312	224	44	17
Geometric mean	13.5						
Standard Geometric Deviation	3.3						
95% results up to	97						

* 1 December 1971 - 30 November 1972

TABLE A-12. SUMMARY OF DATA FOR LEAD IN AIR FOR MEZA VALLEY*

Sampling Site: Mezice

Months	Concentration of lead in air $\mu g/m^3$		Sampling Period: Days	Number of results above $\mu g/m^3$			
	Arithmetic mean	Highest value		2	10	50	100
December	26	152	29	26	20	2	1
January	17	69	29	22	17	4	-
February	21	57	26	21	19	3	-
March	31	59	31	29	27	1	-
April	21	82	29	21	16	5	-
May	26	64	29	28	26	3	-
June	29	65	25	24	20	2	-
July	10	13[x]	31				
August	16	20[x]	31				
September	11	14[x]	30				
October	17	24[x]	31				
November	22	34[x]	27				
Annual Arithmetic Mean	21						

* 1 December 1972 - 30 November 1973

[x] Highest weekly average

TABLE A-13. SUMMARY OF DATA FOR LEAD IN AIR FOR MEZA VALLEY*

Sampling Site: Zerjav

Months	Concentration of lead in air µg/m³		Sampling Period: Days	Number of results above µg/m³			
	Arithmetic mean	Highest value		2	10	50	100
December	45	199	29	29	27	7	2
January	22	60	29	27	20	1	-
February	40	100	26	26	23	9	1
March	35	64	31	31	30	5	-
April	30	80	29	29	27	3	-
May	29	59	29	29	27	1	-
June	28	70	25	25	22	3	-
July	13	25[x]	29				
August	12	16[x]	31				
September	8	10[x]	30				
October	10	12[x]	31				
November	16	22[x]	30				
Annual Arithmetic Mean	24						

* 1 December 1972 - 30 November 1973

[x] Highest weekly average

TABLE A-14. SUMMARY OF DATA FOR LEAD IN AIR FOR MEZA VALLEY*

Sampling Site: Rudarjevo

Months	Concentration of lead in air µg/m³		Sampling Period: Days	Number of results above µg/m³			
	Arithmetic mean	Highest value		2	10	50	100
December	70	286	29	29	28	15	8
January	61	160	29	29	29	14	5
February	50	142	26	25	25	8	1
March	35	75	31	31	28	7	-
April	17	75	20	20	12	2	-
May	21	91	24	22	14	1	-
June	23	60	22	22	15	2	-
July	12	18[x]	29				
August	9	14[x]	31				
September	12	21[x]	30				
October	17	29[x]	31				
November	34	50[x]	30				
Annual Arithmetic Mean	30						

* 1 December 1972 - 30 November 1973

[x] Highest weekly average

TABLE A-15. SUMMARY OF DATA FOR LEAD IN AIR FOR MEZA VALLEY*

Sampling Site: Crna Se

Months	Concentration of lead in air $\mu g/m^3$		Sampling Period: Days	Number of results above $\mu g/m^3$			
	Arithmetic mean	Highest value		2	10	50	100
December	58	255	25	24	22	10	3
January	47	101	29	29	28	13	1
February	46	168	26	25	22	8	2
March	25	91	31	31	22	4	-
April	18	107	29	29	14	2	1
May	17	67	29	27	20	1	-
June	22	82	22	21	15	3	-
July	10	15[x]					
August	5	15[x]					
September	3	6[x]					
October	6	6[x]					
November	7	10[x]					
Annual Airthmetic Mean	22						

* 1 December 1972 - 30 November 1973

[x] Highest weekly average

TABLE A-16. SUMMARY OF DATA FOR LEAD IN AIR FOR MEZA VALLEY*

Sampling Site: Crna W

Months	Concentration of lead in air $\mu g/m^3$		Sampling Period: Days	Number of results above $\mu g/m^3$			
	Arithmetic mean	Highest value		2	10	50	100
December	59	228	29	29	23	12	7
January	44	110	29	29	27	11	2
February	36	90	26	25	22	6	-
March	23	71	31	30	24	1	-
April	13	62	29	26	15	1	-
May	16	67	29	27	19	1	-
June	19	84	25	25	16	1	-
July	11	15[x]					
August	9	13[x]					
September	13	24[x]					
October	17	22[x]					
November	28	38[x]					
Annual Arithmetic Mean	24						

* 1 December 1972 - 30 November 1973

[x] Highest weekly average

TABLE A-17. MASS DISTRIBUTION OF LEAD IN PARTICLES BY SIZE, ZAGREB 1971

Collection Medium: Al-Foils

Date	6-8 September		8-10 September		13-15 September		15-17 September		20-22 September	
Separation stage	µg	5	µg	%	µg	%	µg	%	µg	%
1	23.7	6.9	22.5	5.6	36.6	6.3	13.5	4.8	33.9	8.4
2	12.9	3.7	12.6	3.2	23.4	4.0	7.8	2.8	16.2	4.0
3	15.6	4.5	14.4	3.6	24.6	4.3	10.2	3.6	21.0	5.2
4	18.9	5.5	23.4	5.8	30.0	5.2	15.0	5.3	29.7	7.4
5	14.1	4.1	18.6	4.7	24.6	4.3	10.8	3.8	31.5	7.8
6	259.5	75.3	307.5	77.1	438.9	75.9	223.5	79.7	270.0	67.2
	344.7		399.0		578.1		280.8		402.3	

(continued)

TABLE A-17. (continued)

Collection Medium: Al-Foils

Date	4-7 October		7-9 October		11-13 October		Range %	Average %	Cumulative average %
Separation stage	µg	%	µg	%	µg	%			
1	42.9	8.0	59.1	11.7	59.1	8.2	4.8-11.7	7.5	7.5
2	25.8	4.8	34.8	6.9	34.5	4.8	2.8-6.9	4.3	11.8
3	28.5	5.3	42.9	8.5	42.0	5.9	3.6-8.5	5.1	16.9
4	33.9	6.3	49.5	9.8	51.0	7.1	5.2-9.8	6.6	23.5
5	38.7	7.2	57.6	11.4	62.7	8.8	3.8-11.4	6.5	30.0
6	367.5	68.4	261.0	51.7	467.1	65.2	51.7-79.7	70.0	100.0
	537.3		504.9		716.4				

TABLE A-18. MASS DISTRUBTION OF LEAD PARTICLES BY SIZE, ZAGREB 1972

Collection Medium: Al-Foils

Date	26-27 January		27-28 January		31 January-1 February		Range %	Average %	Cumulative average %
Separation stage	µg	%	µg	%	µg	%			
1	16.5	7.0	16.8	6.7	14.1	6.7	6.7-7.0	6.8	6.8
2	9.9	4.2	9.0	3.6	6.0	2.8	2.8-4.2	3.5	10.3
3	13.5	5.7	9.0	3.6	9.0	4.3	3.6-5.7	4.5	14.8
4	17.1	7.3	24.3	9.7	17.7	8.4	7.3-9.7	8.5	23.3
5	17.1	7.3	16.2	6.5	21.0	10.0	6.5-10.0	8.0	31.3
6	161.1	68.5	174.9	69.9	143.1	67.8	67.8-69.9	68.7	100.0
	235.2		250.2		210.8				

TABLE A-19. MASS DISTRIBUTION OF LEAD PARTICLES BY SIZE, ZAGREB 1972

Sampling Medium: Al-Foil

Date	22-24 May		24-26 May		29-31 May		18-20 July		20-22 July		Range %	Average %	Cumulative average %
Separation stage	µg	%	µg	%	µg	%	µg	%	µg	%			
1	11.4	5.7	19.2	7.3	15.3	5.1	9.9	6.1	7.5	4.5	4.5-7.3	5.7	5.7
2	7.2	3.6	9.6	3.7	7.2	2.4	5.4	3.3	7.5	4.5	2.4-4.5	3.5	9.2
3	9.9	5.0	15.3	5.8	9.6	3.2	6.9	4.2	9.9	5.9	3.2-5.9	4.8	14.0
4	9.9	5.0	23.4	8.9	15.6	5.2	8.4	5.1	15.9	9.5	5.0-9.5	6.7	20.7
5	18.0	9.0	19.5	7.4	57.3	19.1	12.6	7.7	13.5	8.1	7.4-19.1	10.3	31.0
6	143.1	71.7	175.6	66.9	194.7	65.0	120.0	73.5	112.5	67.4	65.0-73.5	68.9	99.9
	199.5		262.5		299.7		163.2		166.8				

TABLE A-20. MASS DISTRIBUTION OF LEAD PARTICLES BY SIZE, ZAGREB 1972

Sampling Medium: Al-Foils

Date	30 August - 1 September		2-4 September		4-6 September		7-9 September		9-11 September	
Separation stage	µg	%	µg	%	µg	%	µg	%	µg	%
1	13.2	7.4	14.4	6.5	27.0	7.0	29.4	9.3	24.9	8.4
2	6.6	3.7	10.2	4.6	15.0	3.9	12.0	3.8	10.5	3.5
3	9.0	5.0	12.0	5.4	19.2	4.9	14.4	4.5	14.1	4.7
4	10.5	5.9	14.4	6.6	31.5	8.1	15.6	5.0	15.0	5.1
5	12.0	6.7	11.4	5.2	20.7	5.4	14.4	4.5	10.5	3.2
6	127.5	71.3	158.4	71.7	273.0	70.9	231.0	72.9	222.6	74.8
	178.8		220.8		386.4		316.8		297.6	

(continued)

TABLE A-20. (continued)

Sampling Medium: Al-Foils

Date	12-14 September		14-16 September		18-20 September		21-22 September		Range %	Average %	Cumulative average %
Separation stage	µg	%	µg	%	µg	%	µg	%			
1	28.5	7.0	19.2	6.5	53.4	10.1	27.9	9.9	6.5-10.1	8.0	8.0
2	15.6	3.8	12.0	4.1	27.3	5.2	10.2	3.6	3.5- 5.2	4.0	12.0
3	19.5	4.8	12.0	4.1	27.3	5.2	15.6	5.6	4.1- 5.4	4.9	16.9
4	26.1	6.4	18.0	6.1	41.4	7.8	20.4	7.2	5.0- 8.1	6.5	23.4
5	24.6	6.0	14.1	4.8	37.2	7.0	21.9	7.8	3.5- 7.0	5.7	29.1
6	295.2	72.0	218.4	74.4	342.3	64.7	185.4	65.9	64.7-74.8	70.9	100.0
	409.5		293.7		528.9		281.4				

TABLE A-21. MASS DISTRIBUTION OF LEAD PARTICLES BY SIZE, ZAGREB 1973

Sampling Medium: Al-Foils

Date	29-31 January		31 January 1,2 February		3-5 February		5-7 February		10-12 February	
Separation stage	µg	%	µg	%	µg	%	µg	%	µg	%
1	93.3	10.9	39.6	8.7	63.6	9.3	58.8	8.4	84.0	10.1
2	44.4	5.2	20.7	4.5	33.9	5.0	28.2	4.0	43.5	5.2
3	45.3	5.3	22.2	4.9	35.1	5.1	33.9	4.9	39.6	4.8
4	76.5	9.0	36.0	7.9	51.9	7.6	50.1	7.2	65.1	7.9
5	93.0	10.9	39.0	8.6	44.7	6.6	50.1	7.2	77.4	9.3
6	502.2	58.7	297.6	65.4	453.6	66.4	475.9	68.3	521.1	62.7
	854.7		455.1		682.8		697.0		830.7	

(continued)

TABLE A-21. (continued)

Sampling Medium: Al-Foils

Date	10-12 February		12-14 February		14-16 February		Range %	Average %	Cumulative average %
Separation stage	µg	%	µg	%	µg	%			
1	36.0	8.6	43.8	8.9	37.8	8.3	8.3-10.9	9.2	9.2
2	16.5	4.0	23.7	4.8	24.9	5.5	4.0- 5.5	4.8	14.0
3	20.4	4.9	22.8	4.6	22.8	5.0	4.6- 5.3	4.9	18.9
4	22.2	5.3	27.3	5.6	34.2	7.5	5.3- 9.0	7.2	26.1
5	19.2	4.6	30.3	6.2	33.6	7.4	4.6- 9.0	7.6	33.7
6	302.4	72.6	343.2	69.9	302.4	66.3	58.7-72.6	66.3	100.0
	416.7		491.1		455.7				

TABLE A-22. MASS DISTRIBUTION OF LEAD PARTICLES BY SIZE, MEZA VALLEY 1972

Sampling Medium: Al-Foils

Site:	Mezice					Zerjav				
Date:	27-28 March		30-31 March			27-28 March		28-29 March		
Separation Stage	µg	%	µg	%	Average %	µg	%	µg	%	Average %
1	502.2	15.0	904.0	17.5	16.3	1395.0	21.2	495.0	16.1	18.6
2	509.4	15.3	920.0	17.8	16.5	1062.0	16.2	675.0	22.0	19.1
3	957.6	28.7	1420.0	27.4	28.0	1629.0	24.8	907.2	29.5	27.2
4	797.4	23.9	1364.0	26.3	25.1	1422.0	21.6	743.4	24.2	22.9
5	415.8	12.5	441.0	8.5	10.5	491.4	7.5	112.0	3.6	5.6
6	154.0	4.6	133.0	2.5	3.6	574.0	8.7	140.5	4.6	6.6
	3336.4		5182.0			6573.4		3073.1		

continued

TABLE A-22. (continued)

Sampling Medium: Al-Foils

Site:	Rudarjevo					Crna W					All Sites		
Date:	29-30 March		30-31 March			28-29 March		29-30 March			Range	Average	Cumulative Average
Separation Stage	µg	%	µg	%	Average %	µg	%	µg	%	Average %	%	%	%
1	957.6	22.3	1072.0	19.4	20.9	468.0	12.7	441.0	14.1	13.4	12.7--22.3	17.3	17.3
2	907.2	21.2	1072.0	19.4	20.3	781.2	21.2	441.0	14.1	17.7	14.1--22.0	18.4	35.7
3	1134.0	26.4	1572.0	28.5	27.4	1062.0	28.9	920.0	29.5	29.2	24.8--29.5	28.0	63.7
4	957.6	22.3	1484.0	26.9	24.6	1029.6	28.0	1052.0	33.8	30.9	21.6--33.8	25.9	89.6
5	197.4	4.6	211.5	3.8	4.2	262.8	7.1	220.0	7.1	7.1	3.6--12.5	6.8	96.4
6	136.5	3.2	113.0	2.0	2.6	76.5	2.1	43.0	1.4	1.7	1.4-- 8.7	3.6	100.0
	4290.3		5524.5			3680.1		3117.0					

TABLE A-23. MASS DISTRIBUTION OF LEAD PARTICLES BY SIZE, MEZA VALLEY 1972

Sampling Medium: Al-Foils

Site:	Mezice					Zerjav				
Date:	5-6 June		8-9 June			5-6 June		6-7 June		
Separation Stage	µg	%	µg	%	Average %	µg	%	µg	%	Average %
1	423	9.2	46	21.1	15.2	402	10.0	275	11.6	10.8
2	802	17.4	26	11.9	14.6	1277	31.7	444	18.8	25.2
3	1412	30.6	36	16.5	23.6	990	24.5	653	27.7	26.1
4	1396	30.3	54	24.8	27.6	792	19.7	545	23.1	21.4
5	354	7.7	25	11.5	9.5	309	7.7	151	6.4	7.1
6	220	4.8	31	14.2	9.5	257	6.4	292	12.4	9.4
	4607		218			4027		2360		

continued

TABLE A-23. (continued)

Sampling Medium: Al-Foils

Site:	Rudarjevo					Crna SE					All Sites		
Date:	5-7 June		7-8 June			7-8 June		8-9 June			Range	Average	Cumulative Average
Separation Stage	µg	%	µg	%	Average %	µg	%	µg	%	Average %	%	%	%
1	102	13.0	24	8.8	10.9	26	4.2	562	9.9	7.0	4.2-21.1	11.1	11.0
2	94	12.0	24	8.8	10.4	50	8.1	984	17.3	12.7	8.1-31.7	15.7	26.7
3	182	23.3	46	16.8	20.0	164	26.7	1712	30.1	28.4	16.5-30.6	24.5	51.2
4	192	24.4	86	31.4	28.0	230	27.5	1744	30.7	34.1	19.7-37.5	27.8	79.0
5	79	10.1	38	13.8	12.0	54	8.8	378	6.7	7.8	6.4-13.8	9.1	88.1
6	134	17.1	56	20.4	18.7	90	14.7	304	5.3	10.0	4.8-20.4	11.9	100.0
	783		274			614		5684					

TABLE A-24. MASS DISTRIBUTION OF LEAD PARTICLES BY SIZE, ZERJAV 1973

Sampling Medium: Al-Foils

Date:	9-10 March		10-11 March		11-12 March		12-13 March		13-14 March	
Separation Stage	µg	%	µg	%	µg	%	µg	%	µg	%
1	2640.0	30.7	1320.0	36.4	1818.0	18.6	954.0	21.8	278.1	20.7
2	2100.0	24.4	978.0	26.9	2286.0	23.3	798.0	18.2	223.2	16.6
3	1980.0	23.3	720.0	19.8	3120.0	32.2	1122.0	25.6	372.0	27.7
4	1302.0	15.2	435.0	12.0	2070.0	21.2	1062.0	24.3	360.0	26.8
5	296.0	3.5	97.8	2.7	310.5	3.2	241.5	5.5	57.6	4.3
6	272.7	3.2	79.8	2.2	161.7	1.7	199.5	4.6	51.3	3.9
	8591.7		3630.6		9748.2		4377.0		1342.2	

continued

TABLE A-24. (continued)

Sampling Medium: Al-Foils

Date:	14-15 March		15-16 March		16-16 March		Range	Average	Cumulative Average
Separation Stage	µg	%	µg	%	µg	%	%	%	%
1	66.0	22.6	1350.0	22.1	474.0	22.6	18.6-36.4	24.4	24.4
2	36.0	12.4	1146.0	18.8	402.0	19.2	12.4-26.9	20.0	44.4
3	53.7	18.4	1734.0	28.4	552.0	26.4	18.4-32.2	25.2	69.2
4	66.9	22.9	1380.0	22.6	459.0	21.9	12.0-26.8	20.9	90.5
5	21.6	7.4	264.0	4.3	85.2	4.1	2.7- 7.4	4.3	94.8
6	47.4	16.3	235.2	3.8	120.9	5.8	1.7-16.3	5.2	100.0
	291.6		6109.2		2093.1				

TABLE A-25. OCCUPATIONAL EXPOSURE OF II-2 GAS STATION EMPLOYEES TO LEAD IN AIR IN ZAGREB*

May-June 1971.

Day	Site 1	Day	Site 2	Day	Site 3	Day	Site 4
Wed.	4.5	Mon.	5.1	Mon.	7.3	Thurs.	4.3
5/26	1.8	5.31		5/31	3.7	6/03	3.5
	7.1				6.3		6.4
	2.4						4.4
Thurs.	3.8	Tues.	3.4	Tues.	5.7	Fri.	4.0
5/27	5.2	6/01	4.0	6/01	5.8	6/04	5.1
	2.9		1.2		19.1		2.9
	8.2				2.7		
Fri.	3.4	Wed.	2.0	Wed.	3.3	Sat.	3.9
5/28	3.4	6/02	2.6	6/02	4.0	6/05	3.2
	4.9		2.0		7.2		2.1
	4.0				3.2		
Σ	51.6		20.3		68.3		46.2
N	12		7		11		10
$\bar{x}$	4.3		2.9		6.2		4.0

September-October 1971.

Mon.	15.5	Mon.	3.5+	Thurs.	5.7	Thurs.	4.2
10/04	4.7	10/04	2.8+	9/30	3.9	10/07	4.5
	4.2				4.0		2.2
	5.6				3.8		
Tues.	2.8	Tues.	6.0+	Fri.	1.3+	Fri.	1.7
10/05	2.2	10/05	1.1	10/01	2.6	10/08	4.8
	1.9				4.2		5.0
	3.1				4.1		3.9
Wed.	2.7	Wed.	2.3	Sat.	4.2	Sat.	10.7
10/06	3.1	10/06		10/02	5.7	10/09	5.0
	3.4				5.4		6.0
					4.7		4.6
Σ	49.2		15.7		49.6		52.6
N	11		5		12		11
$\bar{x}$	4.5		3.1		4.1		4.8

*Measured by personal samplers in $\mu g/m^3$ during the working shift for two 3-day periods at four gas filling stations during May-June 1971 and September-October 1971.

TABLE A-26. SUMMARIZED RESULTS FOR MAY/JUNE AND SEPTEMBER/OCTOBER TOGETHER

Parameter	Site 1	Site 2	Site 3	Site 4	All Sites
Σ	100.8	36.0	117.9	98.8	353.5
N	23	12	23	21	79
$\bar{x}$	4.4	3.0	5.1	4.4	4.3
Total Range	1.1 - 19.1				

TABLE A-27. OCCUPATIONAL EXPOSURE OF II-3 STREETCAR DRIVERS TO LEAD IN AIR*

Line No.		14	10	12	9	5/4	2	15	11
Day									
Wed.	3/31	4.07	5.78	13.40	7.69	5.36	3.66	5.47	
		5.74	4.13	9.08	5.74	5.96	3.46	8.73	7.22
Thurs.	4/01	2.84	5.54	4.76	8.58	6.35	3.46	13.90	7.90
		4.25	5.13	5.41	3.82	5.95	4.30	4.60	6.05
Fri.	4/02	2.94	3.89	3.59	5.54	3.13	4.80	6.19	8.97
		3.99	6.95	5.41	3.74	4.36	4.13	7.25	6.77
	$\Sigma 1$	23.83	31.42	41.65	35.11	31.11	23.81	46.14	36.91
	N_1	6	6	6	6	6	6	6	5
	$\bar{x}_1$	3.98	5.24	6.94	5.85	5.19	3.97	7.69	6.15
Mon.	6/07	2.30	6.60	3.07	3.38	3.34	41.00	2.03	4.89
		3.12	4.09	2.57	3.11	2.95	1.34	2.35	3.22
Tues.	6/08	3.97	3.10		4.76	4.77	24.20		4.32
		2.48	4.19	3.59	3.24	4.16	1.68	3.36	5.35
Wed.	6/09	2.74	2.86	4.26	3.33	3.18	2.69	2.68	6.57
			3.73	4.63	3.97	3.99	2.69	2.80	5.26
Thurs.	6/10	2.70		3.44	7.40	2.72	4.34	2.09	5.40
		2.15	2.50	3.13	4.42	2.84	2.44	2.43	3.20
Fri.	6/11	2.74	2.44	4.40	3.19	3.58	1.52	2.06	2.37
			3.14	2.19	2.98	2.34		2.15	37.60
	$\Sigma 2$	22.20	32.65	31.28	39.78	33.87	81.90	21.95	78.18
	N_2	7	9	9	10	10	9	9	10
	$\bar{x}_2$	2.78	3.63	3.48	3.98	3.39	9.10	2.44	7.82
	$\Sigma 1.2$	46.03	64.07	72.93	74.89	64.98	105.71	68.09	115.09
	$N_{1.2}$	13	15	15	16	16	15	15	15
	$\bar{x}_{1.2}$	3.29	4.27	4.86	4.68	4.06	7.05	4.54	7.67

Total Σ 611.79

Total N 120

Total $\bar{x}$ 5.1

Total Range 1.34 - 41.0

*Measured by personal samplers in $\mu g/m^3$ during the working shift in two streetcars in each of eight lines, March, April and June 1971.

TABLE A-28. OCCUPATIONAL EXPOSURE OF II-4 CUSTOMS OFFICERS TO LEAD IN AIR*

Day	Nova Gorica	Fer-netići	Day	Kozina	Sko-fije	Day	Sen-tilj	G. Rad-gona
Fri. 7/02	5.99 6.51 9.39 4.33 11.79		Mon. 7/12	6.04 4.90 5.20	6.27 7.54	Fri. 7/16	5.74 5.41 6.57	3.81 4.53
Sat. 7/03	7.23 7.94 10.32 17.27 3.69		Tues. 7/13	4.39 8.49 6.17 13.07 11.44	7.98 10.99	Sat. 7/17	12.43 7.71 5.38 9.39	4.69 7.04 3.70 4.51
Sun. 7/04	9.00 8.03 5.95 8.17	4.78 3.47 4.12 5.67	Wed. 7/14	4.76 12.85 13.12 12.61	12.01 11.24	Sun. 7/18	6.90 7.88 25.93 7.51 6.68	2.61 3.89
Mon. 7/05	9.22 8.31 16.38 7.49 4.30	6.17 6.46 4.54 7.53 4.91	Fri. 7/23	10.77 6.61 6.67 5.57 5.47	6.38 5.92 5.19 4.99	Mon. 7/19	3.79 7.35 8.25	8.98 2.79
Tues. 7/06	7.80 9.99 6.27	1.31 2.94 5.68	Sat. 7/24	6.50 6.05 5.22 4.97	11.92 9.07 7.83	Tues. 7/20	12.14 9.44 6.15 2.14	1.62 4.94
Wed. 7/07	3.03 7.58 1.29	1.28 1.00 2.24 1.55	Sun. 7/25	3.67 6.01	10.08 5.48 5.55	Wed. 7/21	5.69 7.74 5.16	

*Measured by personal samplers in $\mu g/m^3$ during working shift at six busy frontier crossings, July 1971.

Continued

TABLE A-28. (Continued)

Day	Nova Gorics	Fer-netici	Day	Kozina	Sko-fije	Day	Sen-tilj	G. Rad-gona
Thurs. 7/08	13.61	0.44						
	8.07	1.16						
	3.48	2.79						
	6.13	2.10						
		4.06						
Fri. 7/09		5.95						
		15.34						
		6.72						
		8.04						
		5.13						
Sat. 7/10		6.63						
		9.25						
		8.94						
		18.65						
		11.98						
Σ	231.56	170.83		170.55	128.44		175.38	52.13
N	29	31		23	16		22	12
$\bar{x}$	8.0	5.5		7.4	8.0		8.0	4.3

Total Σ 928.89

Total N 133

Total $\bar{x}$ 6.78

Total ange 0.44 - 25.93

TABLE A-29. OCCUPATIONAL EXPOSURE OF II-5 TRAFFIC POLICEMEN TO LEAD IN AIR*

Day	Crossing	A	B	C	D	E	F
Wed.	5/26	2.84	5.07†	4.96	5.77	3.66	2.88
Thurs.	5/27	4.35	6.54†	3.85	5.32	3.95	5.92
Fri.	5/28	16.76	9.96†	7.90	8.66	5.07	7.42
Mon.	9/27	10.00	10.65	10.45	7.60	7.42	10.60
Tues.	9/28	15.22	14.50	9.50	11.15	12.10	13.30
Wed.	9.29	5.74	9.72	-	9.34	6.11	8.75
	Σ	54.91	56.44	36.66	47.84	38.31	48.87
	N	6	6	5	6	6	6
	$\bar{x}$	9.15	9.41	7.33	7.97	6.38	8.14

Day	Crossing	G	H	I	J	Day	Crossing	K	L
Mon.	5/31	32.59	7.64	13.66†	15.20	Thurs.	6/03	5.48†	11.57
Tues.	6/01	17.98	4.03	12.57†	11.14				
Wed.	6/02	16.39	8.11	9.40†	36.52				
Thurs.	9/30	15.24	16.97	9.64		Thurs.	10/07	4.92†	5.44†
Fri.	10/01	14.76		11.66†		Fri.	10/08	8.66†	8.34†
Sat.	10/02	15.87		15.55		Sat.	10/09	4.81†	8.32†
Mon.	10/04			15.82					
Tues.	10/05			6.41					
Wed.	10/06			8.88					
	Σ	112.83	36.75	72.48	93.97			32.59	48.43
	N	6	4	6	6			6	6
	$\bar{x}$	18.80	9.19	12.08	15.66			5.43	8.07

Total Σ	680.08
Total N	69
Total $\bar{x}$	9.86
Total Range	2.84 - 36.52

*Measured by personal samplers in $\mu g/m^3$ during the working shift at 12 busy crossings in Zagreb during May, June, September and October of 1971.

†Average of two simultaneous samples, in Total N averages are counted as one result.

TABLE A-30. IV-1 - EXPOSURE TO LEAD OF WORKERS IN LEAD ARTICLE MANUFACTURE (TOP)*

Date	Subject Number	Operation or Occupation		Concentration of lead in air µg/m³			
				Single	Mean	Average	Range
2 June	1	Pressing	Press No 3	0.13			
3	2			0.33			
11	3			0.56			
11	4			0.29	0.33		
2	5		Press No 2	0.06			
3	6			0.34			
9	7			0.13			
9	8			0.24	0.19		
4	9		Press No 1	0.12			
5	10			0.17	0.15		
12	11		Siphon trimming	0.15			
6	12		Siphon press	0.79			
6	13			0.19			
6	14			0.16			
8	15			0.25			
8	16			0.18			
8	17			0.32	0.26	0.26	0.06-0.79
9	18		Plant locksmith	0.11			
11	19		Internal transport	0.15			
12	20			0.12	0.14		
11	21		Foreman	0.14			

* Measured by personal samplers, 2-16 June 1970

continued

TABLE A-30. (continued)

Date	Subject Number	Operation or occupation		Concentration of lead in air µg/m³			
				Single	Mean	Average	Range
4 June	22	Welding	Welder	0.17			
5	23			0.17			
12	24			0.20	0.18		
5	25		Punching	0.07			
6	25			0.20			
8	25			0.13	0.13	0.16	0.07–0.20
4	26	Rolling		0.38			
5	27			0.28	0.33	0.33	0.28–0.38
10	28	Casting		0.06			
10	29			0.06			
10	30			0.05	0.06		
2	31			0.05			
3	32			0.16			
2	33			0.14			
3	34			0.34		0.12	0.05–0.34
15	35		Foreman	0.84			
16	36		Locksmith	0.27			

TABLE A-31. IV-2-EXPOSURE TO LEAD OF WORKERS IN LEAD STORAGE BATTERY PLANT II*

Date	Subject Number	Operation or Occupation	Concentration of lead in air $\mu g/m^3$ Single	Mean	Average	Range
15 February	1	Casting of accumulator parts	1.51			
16	1		0.75			
17	1		0.32	0.88		
15	2		0.36			
16	2		0.27			
17	2		0.31	0.31		
15	3		1.64			
16	3		1.75			
17	3		0.52	1.24		
15	4		0.34			
16	4		0.34			
17	4		0.32	0.34		
15	5		0.40			
16	5		0.46			
17	5		0.38	0.41		
15	6		0.12			
16	6		0.16			
17	6		0.09	0.12		
25	7		0.17			
26	7		0.38	0.28		
25	8		0.29			
26	8		1.05	0.65		
25	9		0.56			
26	9		0.61	0.58		
25	10		0.45			
26	10		0.84	0.65	0.56	0.09-1.75
15	11	Hand pasting	0.83			
16	11		0.37			
17	11		0.31	0.61		
15	12		0.41			
16	12		0.37			
17	12		0.68	0.49		
15	13		0.38	0.38		
15	14		0.98			
16	14		0.68	0.83	0.60	0.31-0.98
15	15	Carpentry	0.04			
16	15		3.60			
17	15		0.51	1.58		
15	16		2.76			
16	16		5.42			
17	16		0.34	3.15	2.47	0.04-5.42

*Measured by personal samplers, 12-26 February 1971.

continued

TABLE A-31. (Continued)

Date	Subject Number	Operation or Occupation	Concentration of lead in air µg/m³ Single	Mean	Average	Range
18 February	17	Mechanical	0.07			
19	17	workshop	0.06			
20	17		0.24	0.12		
18	18		0.11			
19	18		0.04			
20	18		0.04	0.06		
18	19		0.24			
19	19		2.44			
20	19		0.14	0.98		
18	20		0.22			
19	20		0.11			
20	20		0.07	0.14		
18	21		0.11			
19	21		0.21			
20	21		0.16	0.16	0.30	0.04-2.44
18	22	Toolroom	0.11			
19	22	casting	1.37			
20	22		2.42	1.43	1.43	0.11-2.42
18	23	Drying and	1.19			
19	23	formation	0.82			
20	23		0.48	0.83		
18	24		3.53			
19	24		4.45			
20	24		1.53	3.17		
18	25		1.69			
19	25		2.17			
20	25		1.53	1.80	2.04	0.48-4.45
18	26	Station	0.11			
19	26		0.12			
20	26		0.07	0.11	0.11	0.07-0.12
22	27	Preparation of work	0.27	0.27	0.27	
22	28	Packing	0.12			
23	28		0.15			
24	28		0.35	0.23		
22	29		0.20			
23	29		0.18			
24	29		0.20	0.19		
22	30		0.18			
23	30		0.16			
24	30		0.28	0.23		
22	31		0.25			
23	31		0.14			
24	31		0.19	0.19	0.21	0.12-0.35

continued

TABLE A-31. (continued)

Date	Subject Number	Operation or Occupation	Concentration of lead in air $\mu g/m^3$ Single	Mean	Average	Range
22 February	32	Storehouse	0.36			
23	32	of semi-	0.24			
24	32	finished	0.32	0.31		
22	33	products	0.28			
23	33		0.39			
24	33		0.36	0.34		
22	34		0.44			
23	34		0.30			
24	34		0.28	0.34	0.33	0.24-0.44
22	35	Testing	1.13			
23	35	station	1.33	1.23		
22	36		1.31			
23	36		1.02			
24	36		0.44	0.73	0.92	0.44-1.33
22	37	Supply	0.54			
23	37	service	0.12			
24	37		0.11	0.20	0.20	0.11-0.54
22	38	Courtyard	0.46			
23	38	maintenance	1.11			
24	38		0.27	0.62	0.62	0.27-1.11
25	39	Forklift	0.14			
26	39	driver	0.16	0.15	0.15	0.14-0.16

TABLE A-32. EXPOSURE TO LEAD OR WORKERS IN LEAD STORAGE BATTERY PLANT I*

Date	Subject Number	Operation or	Occupation	Concentration of lead in air µg/m³ Single	Average	Range
16 March	1	Mill		19.62	19.62	
13 March	2	Paste	Machine	6.36		
13 March	3	mixing	operator	6.58	6.47	6.36-6.58
11 March	4	Casting	Feeding the melting pot	0.63	0.63	
11 March	5		Casting	4.15		
19 March	6		small parts	0.26	2.21	
19 March	7		Melting pot	3.62		
20 March	8		operator	0.50	2.06	
20 March	9		Casting	0.61	0.61	0.26-4.15
19 March	10	Casting	Plate casting	2.52		
19 March			Punching and triming plates	0.45		0.45-2.52
11 March	12	Mechanical pasting	Transport of ready electrodes	0.81	0.81	
11 March	13		Pasting the grid	1.40		
13 March	13			2.55		
13 March	14			.103	1.66	0.81-2.55

* As measured by personal samplers, 4 to 20 March 1970.

continued

TABLE A-32. (continued)

Date	Subject Number	Operation or Occupation	Concentration of lead in air µg/m³ Single	Average	Range
18 March	15	Drying and formation — Drying ovens operator	7.90		
18 March	16		2.09		
18 March	17		3.71		
18 March	18		2.82	4.13	2.09-7.90
4 March	19	Mechanical processing of electrodes — Sorting polishing of trimmed plates	3.26		
5 March	20	Electrode storage — Transfer of electrodes from the store to the assembly	3.06		
4 March	21	Accumulator assembly — Plate group soldering	25.82		
5 March	22		15.62		
5 March	23		17.20	19.55	
5 March	24	Plate group assembling	2.19	2.19	2.19-25.82
4 March	25	Accumulator assembly — Placing the plate groups into the container and final soldering	1.32		
10 March	26	Electrodes control	2.23		1.32-2.23

continued

TABLE A-32. (continued)

Date	Subject Number	Operation or Occupation	Concentration of lead in air $\mu g/m^3$ Single	Average	Range
10 March	27	Packing Packing of dry electrodes	1.18		
10 March	28		5.89	3.54	1.18-5.89
16 March	29	Mechanical workshop Plant electrician	1.16		
16 March	30	Plant mechanic	1.68		
16 March	31	Mechanic	0.55		0.54-1.68

TABLE A-33. IV-4 EXPOSURE TO LEAD OF WORKERS IN SMELTERY*

Date	Subject Number	Occupation	Shift	Concentration of lead in air $\mu g/m^3$ Single	Mean	Average	Range
28 October	1	Refinery	II	5.16	5.16		
28	2	smelter	I	15.32			
29	2		I	5.74			
30	2		I	5.78	8.95		
28	3		II	4.55	4.55		
28	4		I	7.63			
29	4		I	6.99			
30	4		I	3.77	6.13		
30	5		I	3.76	3.76	6.52	3.76-15.32
28	6	Refinery	II	2.91	2.91		
28	7	foresmelter	II	13.70			
29	7		I	3.30			
30	7		I	2.67	6.56		
29	8		II	5.31			
30	8		II	6.77	6.04		
29	9		II	8.79			
30	9		II	2.68	5.74	5.77	2.67-13.70
29	10	Refinery	II	10.48			
30	10	smelter	II	9.73	10.11		
30	11		II	4.43	4.43	8.21	4.43-10.48
29	12	Refinery	II	0.75			
30	12	assistant	II	2.86	1.80	1.80	0.75-2.86

* Measured by personal samplers, 28 October-6 November 1971.

continued

TABLE A-33. (continued)

Date	Subject Number	Occupation	Shift	Concentration of lead in air µg/m³ Single	Mean	Average	Range
2 Nov	13	Smelter in	II	1.81			
3 Nov	13	silver	II	1.55			
4 Nov	13	refinery	II	1.79	1.72		
30 Oct	14		I	1.39	1.39	1.64	1.39-1.81
30 Oct	15	Refinery	II	0.26			
2 Nov	15	stoker	II	0.32			
3 Nov	15		II	0.34	0.31		
2 Nov	16		I	3.86			
3 Nov	16		I	2.36			
4 Nov	16		I	1.64	2.62	1.46	0.26-3.86
28 Oct	17	Roasting	II	22.06			
29 Oct	17	weigher	II	8.79			
6 Nov	17		I	8.66	13.17		
28 Oct	18		I	21.56			
29 Oct	18		I	29.60	25.58		
5 Nov	19			19.14	19.14	18.30	8.66-29.60
28 Oct	20	Assistant	II	26.06			
29 Oct	20	weigher	II	6.65			
6 Nov	20	(roasting)	I	7.13	13.28		
5 Nov	21		II	2.08	2.08	10.48	2.08-26.06

continued

TABLE A-33. (continued)

Date	Subject Number	Occupation	Shift	Concentration of lead in air µg/m³ Single	Mean	Average	Range
28 Oct	22	Roaster	I	7.53			
29 Oct	22		I	4.66	6.10		
28 Oct	23		II	4.88			
29 Oct	23		II	3.40			
6 Nov	23		I	21.89	10.06		
5 Nov	24		II	6.57	6.57	8.15	3.40-21.89
5 Nov	25	Assistant	II	5.28	5.28		
5 Nov	26	roaster	I	8.78			
6 Nov	26		I	5.82	7.30	6.63	5.28-8.78
28 Oct	27	Dust	I	7.56			
5 Nov	27	collector	I	43.12			
6 Nov	27		I	7.63	19.44	19.44	7.56-43.12
28 Oct	28	Preparation of	I	2.43			
29 Oct	28	concentrate	I	11.26			
3 Nov	28		I	22.93	12.21	12.21	2.43-22.93
28 Oct	29	Blast furnace	II	1.98	1.98		
29 Oct	30	weigher	I	2.11			
29 Oct	30		I	1.78			
30 Oct	30		I	1.60	1.83		
29 Oct	31		II	2.19	2.19	1.93	1.60-21.19

continued

TABLE A-33. (continued)

Date	Subject Number	Occupation	Shift	Concentration of lead in air µg/m³ Single	Mean	Average	Range
28 Oct	32	Blast furnace	I	3.95			
29 Oct	32	smelter	I	3.04			
30 Oct	32		I	4.52	3.84		
28 Oct	33		I	3.98	3.98	3.87	3.04-4.52
29 Oct	34	Blast furnace	II	0.97			
30 Oct	34	foresmelter	II	0.88			
2 Nov	34		II	5.04	2.30		
28 Oct	35		I	1.47			
29 Oct	35		I	2.55			
30 Oct	35		I	4.27	2.76		
28 Oct	36		II	2.46	2.46	2.52	0.88-5.04
29 Oct	37	Blast furnace	II	1.63			
30 Oct	37	assistant	II	0.93			
2 Nov	37	smelter	II	3.49	2.01	2.01	0.93-3.49
3 Nov	38	Blast furnace	II	1.52			
4 Nov	38	cleaner	II	25.55	13.54		
3 Nov	39		II	5.25			
4 Nov	39		II	26.45	15.85		
3 Nov	40		I	0.96	0.96		
3 Nov	40		I	2.14	2.14	10.31	0.96-26.45

continued

TABLE A-33. (continued)

Day	Subject Number	Occupation	Shift	Concentration of lead in air µg/m³ Single	Mean	Average	Range
28 Oct	41	Drum furnace smelter	I	4.66			
29 Oct	41		I	15.78			
30 Oct	41		I	3.04	7.83		
28 Oct	42		II	4.88	4.88		
28 Oct	43		II	2.48	2.48		
29 Oct	44		II	7.22			
30 Oct			II	2.12	4.67	5.74	2.12-15.78
28 Oct	45	Drum furnace foresmelter	I	5.26			
29 Oct	45		I	12.01			
30 Oct	45		I	3.89	7.05		
28 Oct	46		II	20.68	20.68		
30 Oct	47		II	1.02	1.02	8.57	1.02-20.68
30 Oct	48	Drum furnace smelter	II	0.47	0.47		
30 Oct	49		I	2.88	2.88	1.67	0.47-2.88
30 Oct	50	Drum furnace crane operator	II	1.47			
2 Nov	50		II	1.38			
3 Nov	50		II	1.13			
4 Nov	50		II	1.02	1.25		
2 Nov	51		I	3.54			
3 Nov	51		I	0.80			
4 Nov	51		I	1.93	2.09	1.61	0.80-3.54

continued

TABLE A-33. (continued)

Day	Subject Number	Occupation	Shift	Concentration of lead in air µg/m³ Single	Mean	Average	Range
30 Oct	52	Drum furnace	I	3.99			
2 Nov	52	forklifter	I	1.62			
3 Nov	52		I	1.00	2.20		
2 Nov	53		I	1.48			
3 Nov	53		I	0.94	1.21	1.80	0.94-3.99
2 Nov	54	Caster	I	0.49			
3 Nov	54		II	0.67			
5 Nov	54		II	0.49	0.55		
2 Nov	55		I	0.85			
5 Nov	55		II	0.53	0.69		
2 Nov	56		I	0.51			
5 Nov	56		II	0.48	0.50		
4 Nov	57		I	1.10	1.10		
4 Nov	57		I	0.89			
5 Nov	58		II	0.46	0.68		
4 Nov	59		I	0.47			
4 Nov	59		II	3.73	2.10	0.83	0.41-3.73
2 Nov	60	Filter	I	3.21			
3 Nov	60	mechanic	I	1.69			
4 Nov	60		I	29.83	11.57		
2 Nov	61		II	0.69			
3 Nov	61		II	1.65			
4 Nov	61		II	11.04	4.46	8.02	0.69-29.83

continued

TABLE A-33. (continued)

Date	Subject Number	Occupation	Shift	Concentration of lead in air µg/m³ Single	Mean	Average	Range
2 Nov	62	Electrician on duty	II	8.25			
3 Nov	62		II	6.14			
4 Nov	62		II	8.74	7.71		
2 Nov	63		I	5.24			
3 Nov	63		I	4.48			
4 Nov	63		I	4.32	4.68	6.19	4.32-8.74
2 Nov	64	Locksmith on duty	II	3.40			
3 Nov	64		II	3.28			
4 Nov	64		II	2.19	2.96		
2 Nov	65		I	3.93			
3 Nov	65		I	6.48			
4 Nov	65		I	5.51	5.31	4.13	2.19-6.48
2 Nov	66	Truck loader	I	0.40			
3 Nov	66		I	0.48			
4 Nov	66		I	0.28	0.39		
2 Nov	67		II	0.41			
3 Nov	67		II	0.31			
4 Nov	67		II	0.57	0.43	0.41	0.28-0.57
2 Nov	68	Crane operator outdoors	I	2.50			
3 Nov	68		I	2.94			
4 Nov	68		I	4.00	3.15	3.15	2.50-4.00

continued

TABLE A-33. (continued)

Date	Subject Number	Occupation	Shift	Concentration of lead in air µg/m³ Single	Mean	Average	Range
2 Nov	69	Smeltery shift	II	3.09			
3 Nov	69	supervisor	II	0.14			
4 Nov	69		II	3.06	2.10	2.10	0.14-3.09
2 Nov	70	Forklifter	II	0.99			
3 Nov	70	outdoors	II	1.97			
4 Nov	70		II	1.47	1.48		
4 Nov	71		I	1.76			
5 Nov	71		I	1.18	1.47		
4 Nov	72		I	2.83	2.83	1.70	0.99-2.83

continued

TABLE A-33. (continued)

Date	Subject Number	Occupation	Shift	Concentration of lead in air µg/m³ Single	Mean	Average	Range
5 Nov	73	Lead storage	I	0.46			
6 Nov	73	battery	I	0.86	0.66		
6 Nov	74	dept	I	0.77		0.70	0.46-0.86
5 Nov	75	Ball casting	I	2.67			
6 Nov	75		I	0.93	1.80		
5 Nov	76		II	0.45	0.45	1.35	0.45-2.67
5 Nov	77	Mill	I	2.13			
6 Nov	77		I	0.70	1.42		
5 Nov	78		II	5.43	5.43		
5 Nov	79		II	0.41	0.41	2.17	0.41-5.43
5 Nov	80	Sieving	I	0.50	0.50		
5 Nov	81		I	0.40	0.40	0.45	0.40-0.50
5 Nov	82	Packing	I	0.74			
5 Nov	83	Paste mixing	I	12.91			
5 Nov	84	Mason	I	0.47			

TABLE A-34. ATMOSPHERIC LEAD CONCENTRATIONS IN ZAGREB*

Date	Crnomerec	Ingra	Vrbanićeva	Partizen	IMI
1-2 March		0.62			0.36
2-3		0.71			1.21
3-4					
4-5					
5-6					
6-7	0.49	0.23			1.66
7-8	0.60	0.59			1.81
8-9	0.32	0.63			1.68
9-10	0.92	1.62			2.26
10-11	0.78				
11-12					
12-13					
13-14	0.71	0.69	0.36	1.21	0.86
14-15	1.02	0.51	1.42	1.93	1.52
15-16	0.67	1.62	1.80	2.60	1.97
16-17	1.81	0.52	2.44	0.58	0.89
17-18			2.94		
18-19					
19-20					
20-21	1.30	1.27	1.91	0.93	1.15
21-22	0.83	1.08	0.35	1.61	2.16
22-23	0.92	1.37	2.06	1.74	2.21
23-24	0.62	0.13	2.31	1.54	1.35
24-25	0.33				
25-26					
26-27					
27-28	0.57	0.72	0.78	1.02	1.33
28-29	0.21	0.35	0.46	0.26	0.79
29-30	0.03	1.46	1.18	0.95	1.27
30-31		0.47	0.94	0.72	1.87
31 March-1 April	0.09		0.63		
Total	12.22	14.59	19.58	15.09	26.35
N	18	18	14	12	18
Arithmetic Mean	0.68	0.81	1.40	1.26	1.46
Maximum	1.81	1.62	2.94	2.60	2.26
Minimum	0.03	0.13	0.35	0.58	0.36

* In $\mu g/m^3$, March 1972

TABLE A-35. ATMOSPHERE LEAD CONCENTRATIONS IN ZAGREB*

Date	Crnomerec	Ingra	Vrbanićeva	Partizan	IMI
1-2 April	0.21				
2-3	0.67				
3-4		0.31	0.75	0.77	0.99
4-5	0.17	0.20	0.40	0.34	0.62
5-6	0.37	0.47		0.30	1.00
6-7	0.36	1.23	0.84	0.77	1.27
7-8	0.68				
8-9	0.23				
9-10	0.27				
10-11	0.28	0.31	0.24	0.53	0.94
11-12	0.47	1.15	0.85	0.63	1.72
12-13	0.36	0.98	0.92		0.85
13-14		0.53	0.46	0.32	0.78
14-15					
15-16					
16-17					
17-18	0.28	1.48	0.74	0.29	0.34
18-19	0.23	0.67	0.92	0.43	1.04
19-20	0.35	0.51	0.60	0.23	0.65
20-21	0.22	0.54	0.49	0.19	0.31
21-22	0.25				
22-23					
23-24					
24-25	0.29	0.59	0.45	0.24	0.90
25-26	0.24	0.23	0.41	0.21	0.66
26-27	0.36	1.18	0.93	0.67	0.68
27-28	0.28	0.44	0.56	0.37	0.59
28-29					
29-30					
30 April-1 May					
Total	6.57	10.82	9.56	6.29	13.34
N	20	16	15	15	16
Arithmetic Mean	0.33	0.68	0.64	0.42	0.83
Maximum	0.68	1.48	0.93	0.77	1.72
Minimum	0.17	0.20	0.24	0.19	0.31

* In $\mu g/m^3$, April 1972

TABLE A-36. ATMOSPHERIC LEAD CONCENTRATIONS IN ZAGREB*

Date	Crnomerec	Ingra	Vrbanićeva	Partizan	IMI
3-4 May	0.23	0.48	0.48	0.20	0.65
4-5	0.10	0.66	0.42	0.36	0.59
5-6	0.50		0.71		
6-7	0.50				
7-8	0.50				
8-9	0.63	0.70	0.57	0.68	0.97
9-10	0.48	0.95	0.88	0.68	0.73
10-11	0.33	0.69		0.54	0.65
11-12	0.25	0.07	0.30		0.92
12-13	0.40		0.25	0.71	
13-14					
14-15					
15-16	0.46	0.85	0.69		1.74
16-17	0.44	0.55	0.85	0.41	0.90
17-18	0.44	0.92	0.60	0.72	1.29
18-19	0.39	1.25	1.00	0.35	1.47
19-20	0.17		0.42		
20-21					
21-22					
22-23	0.30		0.68	0.58	0.67
23-24	0.25		0.80	0.70	1.23
24-25	0.19		0.52	0.45	0.55
25-26	0.63		0.70	0.55	0.95
26-27			0.19		
27-28					
28-29					
29-30	0.34	1.63	0.53	0.39	0.59
30-31	0.30	0.18	0.43	0.37	0.71
31 May-1 June	0.46	0.28	0.33	0.17	0.58
Total	8.29	9.21	11.35	7.86	15.19
N	22	13	20	16	17
Arithmetic Mean	0.38	0.72	0.57	0.49	0.89
Maximum	0.63	1.63	1.00	0.72	1.74
Minimum	0.10	0.07	0.19	0.17	0.55

* In $\mu g/m^3$, May 1972

TABLE A-37. ATMOSPHERIC LEAD CONCENTRATIONS IN ZAGREB*

Date	Crnomerec	Ingra	Vrbanićeva	Partizan	IMI
1-2 June	0.41	0.57	0.38	0.27	0.85
2-3	0.36				
3-4					
4-5					
5-6	0.28	0.40	0.57	0.33	0.70
6-7	0.28	0.20	0.66	0.56	0.79
7-8	0.37	0.48	0.52	0.53	0.79
8-9	0.50	0.43	0.32	0.14	0.48
9-10			0.63		
10-11					
11-12					
12-13	0.28	0.55	0.44	0.70	0.66
13-14	0.30	0.28	0.26	0.24	0.86
14-15	0.37	0.26	0.23	0.21	0.67
15-16		0.25	0.26		0.70
16-17	0.27		0.26		
17-18					
18-19					
19-20	0.34	0.58	0.50	0.55	0.90
20-21	0.36	0.40	0.37	0.23	0.54
21-22	0.30	0.84	0.68	0.44	0.79
22-23	0.65	0.27	1.43	0.82	1.03
23-24			0.71		0.48
24-25					
25-26					
26-27	0.30	0.53	0.53	0.30	0.67
27-28	0.40	0.26	0.59		0.67
28-29		0.63	1.14		1.04
29-30	0.34	0.45	0.55	1.00	0.86
30 June-1 July					
Total	6.11	7.38	11.03	6.32	13.48
N	17	17	20	14	18
Arithmetic Mean	0.36	0.43	0.55	0.45	0.75
Maximum	0.65	0.84	1.43	1.0	1.04
Minimum	0.27	0.20	0.23	0.14	0.48

* In $\mu g/m^3$, June 1972

TABLE A-38. ATMOSPHERIC LEAD CONCENTRATIONS IN ZAGREB*

Date	Crnomerec	Ingra	Vrbanićeva	Partizan	IMI
1-2 July					
2-3					
3-4					
4-5					
5-6	0.22	0.65	0.59	0.58	0.52
6-7	0.23	0.52	0.69	0.47	0.79
7-8	0.29		0.77		
8-9					
9-10					
10-11	0.17	0.38	0.57	0.26	0.31
11-12	0.17	1.02	0.49	0.17	0.42
12-13	0.26	0.22	0.42	0.36	0.70
13-14	0.13	0.33	0.45	0.16	0.59
14-15	0.22		0.64		0.55
15-16					
16-17					
17-18	0.32	0.38	0.43	0.46	0.77
18-19		0.47	0.59	0.42	0.73
19-20	0.33	0.63	1.49	0.59	0.78
20-21	0.21	0.73	0.60	0.49	0.80
21-22	0.15		0.62		0.95
22-23					
23-24					
24-25	0.49	0.51	0.84	0.62	0.49
25-26	0.32	0.21	0.47	0.38	0.77
26-27			0.45	0.28	
27-28			0.34	0.37	
28-29			0.53		
29-30					
30-31					
31 July-1 August	0.28		0.55	0.44	0.54
Total	3.79	6.05	11.53	6.05	9.71
N	15	12	19	15	15
Arithmetic Mean	0.25	0.50	0.61	0.40	0.65
Maximum	0.49	1.02	1.49	0.62	0.95
Minimum	0.13	0.21	0.34	0.16	0.31

* In $\mu g/m^3$, July 1972

TABLE A-39. ATMOSPHERIC LEAD CONCENTRATIONS IN ZAGREB*

Date	Crnomerec	Ingra	Vrbanićeva	Partizan	IMI
1-2 August	0.25	0.30	0.36	0.38	0.52
2-3	0.13	0.46	0.36	1.07	0.86
3-4	0.29	0.25	0.36	0.44	1.06
4-5	0.24				
5-6					
6-7					
7-8	0.28	0.63	0.40	0.47	0.71
8-9		0.25	0.40	0.39	0.74
9-10	0.36	0.74	0.54	0.70	0.94
10-11	0.25	0.92	0.87	0.36	0.73
11-12	0.36				
12-13					
13-14					
14-15	0.41	0.48	0.18	0.37	0.70
15-16	0.33	0.65	0.55	0.16	0.84
16-17	0.18	0.34	0.15	0.59	0.64
17-18	0.21	0.25	0.21	0.23	0.45
18-19	0.23				
19-20					
20-21					
21-22	0.05	0.56		0.59	1.33
22-23	0.45	0.59	0.55	0.60	0.69
23-24	0.32	0.71	0.72	0.84	0.81
24-25	0.45	0.91	0.95	0.71	0.80
25-26					
26-27					
27-28					
28-29	0.34	0.22	0.51	0.47	0.78
29-30	0.23	0.22	0.66	0.48	0.75
30-31	0.32	0.53	0.22	0.41	0.49
31 Aug.-1 Sept.	0.28	0.70	0.60	0.77	0.75
Total	5.96	9.71	8.59	10.03	14.59
N	21	19	18	19	19
Arithmetic Mean	0.28	0.51	0.48	0.53	0.77
Maximum	0.45	0.92	0.95	1.07	1.33
Minimum	0.05	0.22	0.15	0.16	0.45

* In $\mu g/m^3$, August 1972

TABLE A-40. ATMOSPHERIC LEAD CONCENTRATIONS IN ZAGREB*

Date	Crinomerec	Ingra	Vrbanićeva	SHP	IMI
1-2 September	0.29		0.83		
2-3					0.54
3-4					0.54
4-5	0.45	0.72	0.75		0.99
5-6	0.50	0.53	0.66	0.67	0.99
6-7	0.55	0.66	0.90	1.14	0.78
7-8	0.43	0.45	0.70	1.02	1.20
8-9			0.69		1.20
9-10					0.79
10-11					0.79
11-12	0.37	0.30	0.78	1.33	1.10
12-13	0.34	0.91	1.07	0.97	1.34
13-14	0.69	0.62	0.96	0.99	1.34
14-15	0.54	0.13	0.91	1.33	1.01
15-16	0.28				1.01
16-17					
17-18					
18-19	0.89	0.54		0.53	1.74
19-20	0.69	0.62	1.48	0.47	1.74
20-21	0.77	2.04	1.61	1.61	1.82
21-22	0.70	0.84	1.32	1.57	0.70
22-23			1.39		
23-24					
24-25					
25-26	0.52	0.13	1.15	0.40	0.59
26-27	0.45	0.45	0.50	0.21	0.36
27-28	0.42	0.55	1.0	0.48	0.63
28-29	0.45	0.11	0.93	0.36	0.74
29-30	0.22		0.53		
30 Sept.-1 Oct.	0.22				
Total	9.77	9.6	18.16	13.08	21.94
N	20	16	18	15	22
Arithmetic Mean	0.49	0.60	0.95	0.87	0.99
Maximum	0.89	2.04	1.61	1.61	1.82
Minimum	0.22	0.11	0.50	0.21	0.36

* In $\mu g/m^3$, September 1972

TABLE A-41. ATMOSPHERIC LEAD CONCENTRATIONS IN ZAGREB*

Date	Crnomerec	Ingra	Vrtanićeva	SHP	IMI
1-2 October					
2-3	0.41	0.63	0.50	0.33	0.48†
3-4	0.24	0.33	0.52	0.17	0.12†
4-5	0.24	0.16	0.32	0.10	0.30
5-6	0.67	0.13	0.63	0.45	0.23
6-7					
7-8					
8-9					
9-10	0.48	0.64	0.50	0.25	0.87
10-11	1.35	0.30	0.87	1.24	1.49
11-12	0.31	0.11	0.71	1.48	1.07
12-13	0.41	0.22	0.51	0.65	1.04
13-14	0.18		0.59		
14-15					
15-16					
16-17	0.39	0.51	0.52	0.69	0.51
17-18	0.53	0.96	1.47	1.33	0.94
18-19	0.33	0.36	0.82	0.57	0.83
19-20		0.35	0.51	0.93	0.72
20-21	0.30				
21-22					
22-23					
23-24	0.46		0.80	1.56	1.46
24-25	1.03	1.75	0.90	2.17	2.67
25-26	0.79	2.24	2.06	2.02	1.69
26-27	0.73		2.56	2.28	2.09
27-28	0.35	1.14	1.51		
28-29					
29-30					
30-31	1.04	2.57	1.01	1.10	1.85
31 Oct.-1 Nov.	0.83	0.46	1.89	2.37	2.06
Total	11.07	12.86	19.20	19.69	20.42
N	20	17	20	18	18
Arithmetic Mean	0.55	0.75	0.96	1.09	1.13
Maximum	1.35	2.57	2.56	2.37	2.67
Minimum	0.24	0.11	0.32	0.10	0.12

* In $\mu g/m^3$, October 1972
† Air volume uncertain

TABLE A-42. ATMOSPHERIC LEAD CONCENTRATIONS IN ZAGREB*

Date	Crnomerec	Ingra	Vrbanićeva	SHP	IMI
1-2 November	0.63	0.12	1.14	0.56	0.96
2-3	0.54	0.24	0.83	2.63	1.06
3-4	1.02		2.83		
4-5					
5-6					
6-7	0.47	1.80	2.87	4.97	2.95
7-8	0.90	2.77	3.61	3.14	1.74
8-9	0.57	1.69	4.12	2.56	2.53
9-10	0.99	3.55	3.87	3.08	1.64
10-11	2.83		2.13		
11-12					
12-13					
13-14		0.93	0.83	0.63	1.58†
14-15	1.61	0.82	0.76	2.05	1.58†
15-16	0.52	0.65	0.38	1.31	1.09
16-17	1.31	0.63	0.57	1.46	0.81
17-18			0.61		
18-19	0.72				
19-20					
20-21	1.27	0.88	0.62	1.69	0.95
21-22	4.38	1.42	0.88	2.43	2.30
22-23	0.80	0.73	1.03	0.85	0.93
23-24	0.27	0.55	0.34	0.52	0.35
24-25	0.67		0.36		
25-26					
26-27					
27-28	2.23	1.37	1.22	1.33	2.36
28-29					
29-30					
30 Nov.-1 Dec.					
Total	21.73	18.15	29.00	29.21	22.83
N	18	15	19	15	15
Arithmetic Mean	1.20	1.21	1.52	1.95	1.52
Maximum	4.38	3.55	4.12	4.97	2.95
Minimum	0.27	0.12	0.34	0.52	0.35

* In $\mu g/m^3$, November 1972
† Filter not changed

TABLE A-43. ATMOSPHERIC LEAD CONCENTRATIONS IN ZAGREB*

Date	Crnomerec	Ingra	Vrbanićeva	SHP	IMI
1-2 December					
2-3					
3-4					
4-5	1.48	1.38	1.32	2.52	2.70
5-6	0.54	1.73	1.10	1.20	1.00
6-7	2.65	1.64	1.69	1.70	1.02
7-8		0.50	0.54	0.77	0.31
8-9	2.23		0.31		
9-10					
10-11					
11-12	0.89	0.70	0.47	0.73	0.63
12-13	1.98	0.28	0.30	0.66	0.47
13-14		0.32	0.30	0.47	0.82
14-15		0.66	0.27	0.71	0.91
15-16	1.53		0.32		
16-17					
17-18					
18-19	0.49	0.56	0.32	0.61	0.75
19-20	1.21	0.77	0.54	0.70	0.49
20-21	0.37	0.75	0.35	0.66	0.26
21-22	0.53	0.63	0.21	0.74	0.62
22-23	1.47		0.74		
23-24					
24-25					
25-26	0.56		0.24	0.69	0.33
26-27	0.35	0.51	0.19	0.93	0.32
27-28	0.25	0.42	0.27	0.90	0.67
28-29	0.20	0.40	0.43	0.55	0.43
29-30	0.14		0.47		
30-31					
31 Dec.-1 Jan.					
Total	16.87	11.25	10.38	14.54	11.73
N	17	15	20	16	16
Arithmetic Mean	0.99	0.75	0.52	0.91	0.73
Maximum	2.65	1.73	1.69	2.52	2.70
Minimum	0.14	0.28	0.19	0.47	0.31

* In $\mu g/m^3$, December 1972

TABLE A-44. ATMOSPHERIC LEAD CONCENTRATIONS IN ZAGREB*

Date	Crnomerec	Ingra	Vrbanićeva	SHP	IMI
1-2 January					
2-3					
3-4	0.20	0.64	0.76	1.06	1.58
4-5	0.30	0.57	0.44	1.20	1.38
5-6	0.80		1.13	1.18	
6-7					
7-8					
8-9	0.20	0.78	0.24	0.50	0.36
9-10	0.27	0.15	0.36	0.63	0.60
10-11	0.17	0.48	0.37	0.71	0.70
11-12	0.35		0.64	1.15	1.09
12-13	0.86		1.01		
13-14	0.86				
14-15					
15-16	1.92	0.83	1.41	2.03	2.19
16-17	0.22	0.35	0.35	0.70	0.46
17-18	0.39	0.41	0.48	0.83	0.96
18-19	0.82	0.69	0.81	1.11	3.43
19-20	0.73		0.71		
20-21					
21-22					
22-23	0.46	0.33	0.43	0.74	0.61
23-24	0.27	0.45	0.35	0.51	0.30
24-25	0.29	0.14	0.23	0.47	0.17
25-26	0.24	0.60	0.23	0.40	0.27
26-27	0.33		0.29		
27-28					
28-29					
29-30	0.92	0.82	1.08	1.87	1.51
30-31		2.68	1.38	2.24	2.88
31 Jan.-1 Feb.	0.11	0.50	1.46	1.66	1.34
Total	10.71	10.42	14.16	18.99	19.83
N	21	16	21	18	17
Arithmetic Mean	0.51	0.65	0.67	1.06	1.17
Maximum	1.92	2.68	1.46	2.24	3.43
Minimum	0.11	0.14	0.24	0.40	0.17

* In $\mu g/m^3$, January 1973

TABLE A-45. ATMOSPHERIC LEAD CONCENTRATIONS IN ZAGREB*

Date	Crnomerec	Ingra	Vrbanićeva	SHP	IMI
1-2 February	0.31	0.93	0.38	0.68	0.49
2-3	0.32		0.50	0.50	
3-4	0.56				
4-5	0.38				
5-6	0.30	1.10	1.72	2.00	1.05
6-7	0.73	0.45	1.39	2.57	0.78
7-8	1.30	1.13	1.82	1.07	3.23
8-9	0.87	0.78	1.09	1.54	1.07
9-10	0.45		0.43		
10-11					
11-12					
12-13	0.39	0.98	0.40	1.27	0.93
13-14	0.86	0.55	1.03	1.50	0.91
14-15	0.29	0.42	0.78	0.39	0.32
15-16	0.40	1.60	1.08	1.14	1.12
16-17	0.39		0.49		
17-18					
18-19					
19-20	0.27	2.58	1.46	1.53	0.58
20-21	0.23	1.18	1.67	0.48	0.81
21-22	0.53	0.55	0.68	1.49	2.27
22-23	0.23	0.68	0.83	1.05	0.76
23-24	0.29		0.43		
24-25					
25-26					
26-27	0.22	0.36	0.58	0.30	0.79
27-28	0.18	0.39	0.34	0.18	0.30
28 February-1 March	0.18	0.14	0.33	0.53	
Total	9.68	13.82	16.34	18.22	15.41
N	22	16	20	17	15
Arithmetic Mean	0.44	0.86	0.82	1.07	1.03
Maximum	1.30	2.58	1.82	2.57	3.23
Minimum	0.18	0.14	0.33	0.18	0.30

* In $\mu g/m^3$, February 1973

TABLE A-46. ATMOSPHERIC LEAD CONCENTRATIONS IN MEZA VALLEY*

Number	Date	Mezice (VI)	Zerjav (III)	Rudarjevo (I)	Crna SE (V)	Crna W (II)
1	1-2 December	1.7	24.5	44.7	40.8	40.0
10	2-3	1.0	16.9	88.0	53.6	54.4
11	3-4	7.3	10.1	62.5	122.8	128.2
12	6-7	42.0	73.5	42.6	42.4	52.7
13	7-8	2.3	5.9	148.9	147.0	98.5
14	8-9	1.1	2.3	21.0	10.7	13.4
15	9-10	45.8	66.4	63.6	61.7	66.6
	10-11	45.8	66.4	63.6	61.7	66.6
16	13-14	23.7	47.9	42.9	33.4	24.2
17	14-15	77.1	37.4	21.8	LOST	25.8
18	15-16	30.6	10.2	4.4	12.1	61.0
19	16-17	75.2	41.5	14.2	13.7	7.5
20	17-18	52.4	13.0	3.2	8.6	4.1
21	18-19	58.8	23.1	3.8	8.2	4.8
22	21-22	66.5	30.7	26.1	22.5	13.9
23	22-23	48.0	22.2	24.8	26.7	19.1†
24	23-24	28.4	29.6	31.6	12.4	10.6
	24-25	28.4	29.6	31.6	12.4	10.6†
25	25-26	13.2	6.7	6.0	4.0	1.6
	26-27	13.2	6.7	6.0	4.1	1.6†
26	27-28	42.2	20.6	25.8	23.6	18.9
	28-29	42.2	20.6	25.8	23.6	18.9
27	29-30	1.9	9.6	12.3	9.6	11.3
28	30-31	1.1	61.4	32.4	20.7	21.4
Arithmetic Mean N=24		31.2	28.2	35.3	33.7	32.3
Maximum		77.1	73.5	148.9	147.0	128.2
Minimum		1.0	2.3	3.2	4.1	1.6
No. of results above 10 $\mu g/m^3$		17	19	19	18	19
No. of results above 50 $\mu g/m^3$		5	4	5	5	7
No. of results above 100 $\mu g/m^3$		-	-	1	2	1

* In $\mu g/m^3$, 1 December to 31 December 1971
† Filter not exchanged

TABLE A-47. ATMOSPHERIC LEAD CONCENTRATIONS IN MEZA VALLEY*

Number	Date	Mezice (VI)	Zerjav (III)	Rudarjevo (I)	Crna SE (V)	Crna W (II)
29	3-4 January	0.94	2.6	18.2	22.6	21.1
30	4-5	0.62	2.6	77.8	62.6	68.8
31	5-6	1.12	12.6	51.7	22.6	19.0
32	6-7	1.57	34.9	109.0	47.6	52.7†
33	7-8	29.0	58.0	70.1	43.5	47.8†
	8-9	29.0	58.0	70.1	43.5	47.8
34	9-10	16.9	89.1	32.6	19.1	11.4
35	10-11	33.8	80.1	77.7	44.1	30.8
36	11-12	24.0	23.1	113.9	68.0	84.8
37	12-13	0.82	11.7	9.2	0.93	0.7
38	13-14	29.6	30.8	63.7	30.0	41.3
39	14-15	2.60	27.6	10.0	55.2	71.0†
40	15-16	4.90	38.9	30.8	37.8	22.6†
	16-17	4.90	38.9	30.8	37.8	22.6
41	17-18	0.75	1.2	185.0	193.8	204.0
42	18-19	66.5	12.0	328.0	258.5	222.0†
43	19-20	15.7	53.6	159.0	83.4	131.0†
	20-21	15.7	53.6	159.0	83.4	131.0
44	21-22	6.5	75.5	137.8	131.0	107.0†
45	22-23	37.8	65.4	270.0	99.6	161.0†
	23-24	37.8	65.4	270.0	99.6	161.0
46	24-25	2.3	9.5	129.0	103.5	95.5
47	25-26	69.5	43.9	90.8	106.0	88.7
48	26-27	61.6	99.0	159.5	158.0	136.0
49	27-28	22.2	92.6	227.5	204.0	161.0†
50	28-29	54.6	45.8	160.0	77.5	119.8†
	29-30	54.6	45.8	160.0	77.5	119.8
51	30-31	143.0	103.1	109.8	104.0	78.4
52	31 Jan.-1 Feb.	236.0	216.5	234.0	199.8	157.1
Arithmetic Mean N=29		34.6	51.4	122.3	102.4	90.2
Maximum		236.0	216.5	328.0	258.5	222.0
Minimum		0.62	1.2	9.2	0.93	0.7
No. of results above 10 $\mu g/m^3$		18	25	27	28	28
No. of results above 50 $\mu g/m^3$		7	13	23	18	19
No. of results above 100 $\mu g/m^3$		2	2	16	9	12

* In $\mu g/m^3$, 3 January to 1 February 1972
† Filter not exchanged

TABLE A-48. ATMOSPHERIC LEAD CONCENTRATIONS IN MEZA VALLEY*

Number	Date	Mezice (VI)	Zerjav (III)	Rudarjevo (I)	Crna SE (V)	Crna W (II)
53	1-2 February	1.1	3.9	256.5	166.4	211.0
54	2-3	2.4	11.4	187.2	171.0	194.0
55	3-3	2.1	38.0	77.1	43.5	35.7
56	4-5	1.8	15.4	105.3	150.8	147.5†
57	5-6	34.3	70.6	Lost	89.0	81.4
	6-7	34.3	70.6	Lost	89.0	81.4
58	7-8	154.3	120.5	83.0	46.4	54.2
59	8-9	103.9	43.3	16.9	6.7	12.9
60	9-10	33.0	42.5	34.6	42.6	26.6
61	10-11	52.4	52.3	79.6	55.7	53.5
62	11-12	26.9	124.0	12.4	13.2	25.2†
63	12-13	2.8	21.6		29.6	2.5
	13-14	2.8	21.6		29.6	2.5
64	14-15	0.4	1.9		2.4	1.5
65	15-16	31.6	73.3		33.4	25.6
66	16-17	40.3	35.2		21.3	19.2
67	17-18	51.4	27.3		31.2	24.1
68	18-19	39.1	61.8		3.2	2.8†
69	19-20	11.9	17.9		13.2	8.3
	20-21	11.9	17.9		13.2	8.3
70	21-22	2.9	17.7		32.7	23.0
71	22-23	0.8	5.8	35.5	32.0	34.5
72	23-24	9.3	19.1	22.2	19.3	15.3†
73	24-25	5.4	12.0	6.8	5.0	3.8
	25-26	5.4	12.0	6.8	5.0	3.8†
74	26-27	2.9	5.1	1.6	0.6	0.5
	27-28	2.9	5.1	1.6	0.6	0.5
75	28-29	2.0	3.1	1.7	0.7	0.7
76	29 Feb.-1 Mar.	1.3	3.4	1.4	0.5	0.3
Arithmetic Mean N=29 (17)		23.2	32.9	(54.7)	39.6	37.9
Maximum		154.3	124.0	256.5	171.0	211.0
Minimum		0.4	1.9	1.4	0.5	0.3
No. of results above 10 $\mu g/m^3$		13	22	11	20	17
No. of results above 50 $\mu g/m^3$		4	7	6	6	7
No. of results above 100 $\mu g/m^3$		2	2	3	3	3

* In $\mu g/m^3$, 1 February to 1 March 1972
† Filter not exchanged

TABLE A-49. ATMOSPHERIC LEAD CONCENTRATIONS IN MEZA VALLEY*

Number	Date	Mezice (VI)	Zerjav (III)	Rudarjevo (I)	Crna SE (V)	Crna W (II)
77	1-2 March	1.7	2.3	1.9	0.3	0.5†
78	2-3	7.6		11.7	13.5	10.8
	3-4	7.6		11.7	13.5	10.8†
79	4-5	17.2	19.4	2.8	1.8	1.6
	5-6	17.2	19.4	2.8	1.8	1.6
80	6-7	15.3	33.9	42.4	48.8	26.2
81	7-8	7.8	23.8	29.1	18.0	13.6
82	8-9	29.9	22.4	17.7	16.5	12.9
83	9-10	19.1	27.1	61.3	66.5	53.5
84	10-11	27.1	61.6	15.1	14.9	11.4†
85	11-12	1.6	2.8	10.4	17.3	12.6
	12-13	1.6	2.8	10.4	17.3	12.6
86	13-14	14.5	28.4	70.3	32.2	20.1
87	14-15	20.0	32.2	41.1	24.2	18.3†
88	15-16	89.7	34.0	40.7	54.4	17.2
	16-17	89.7	34.0	40.7	54.4	17.2
89	17-18	49.6	24.7	33.4	18.3	17.4†
90	18-19	45.8	22.8	26.7	15.3	17.9
	19-20	45.8	22.8	26.7	15.3	17.9†
91	20-21	55.1	52.3	31.2	20.5	29.8
	21-22	55.1	52.3	31.2	20.5	29.8
92	22-23	46.7	26.0	23.8	18.1	14.8
93	23-24	53.2	28.6	29.8	16.6	19.7
94	24-25	20.6	25.5	24.5	21.0	17.1†
95	25-26	34.1	25.2	33.5	16.2	16.6
	26-27	34.1	25.2	33.5	16.2	16.6
96	27-28	30.6	52.0	14.7	22.2	12.9
97	28-29	8.6	28.4	55.8	34.8	36.2
98	29-30	30.8	19.8	36.8	46.5	35.5
99	30-31	51.4	82.0	37.2	33.5	23.8
100	31 Mar.-1 Apr.	45.7	32.2	23.2	5.3	22.4
Arithmetic Mean N=31 (29)		31.4	(29.8)	28.1	23.1	18.4
Maximum		89.7	82.0	70.3	66.5	53.5
Minimum		1.6	2.3	1.9	0.3	0.5
No. of results above 10 $\mu g/m^3$		24	26	28	27	28
No. of results above 50 $\mu g/m^3$		6	5	3	3	1
No. of results above 100 $\mu g/m^3$						

* In $\mu g/m^3$, 1 March to 1 April 1972
† Filter not exchanged

TABLE A-50. ATMOSPHERIC LEAD CONCENTRATIONS IN MEZA VALLEY*

Number	Date	Mezice (VI)	Zerjav (III)	Rudarjevo (I)	Crna SE (V)	Crna W (II)
101	1-2 April	24.2	30.8	52.3	51.8	40.2†
	2-3	24.2	30.8	52.3	51.8	40.2
102	3-4	36.5	41.8	62.5	72.5	47.5
103	4-5	33.4	37.6	24.6	1.9	2.8†
104	5-6	19.8	15.3	50.8		49.3
	6-7	19.8	15.3	50.8		49.3
105	7-8	78.3	60.0			32.0†
106	8-9	41.9	56.5	22.0		6.1
	9-10	41.9	56.5	22.0		6.1†
107	10-11	24.7	42.2	25.2		16.7
	11-12	24.7	42.2	25.2		16.7
108	12-13	3.8	10.6	15.8	28.1	16.5
109	13-14	0.6	32.7	31.5	47.7	34.5
110	14-15	17.4	37.1	48.2	47.0	37.5†
111	15-16	20.7	38.2	26.8	46.1	42.0
	16-17	20.7	38.2	26.8	46.1	42.0
112	17-18	79.4	104.5	2.0	2.2	1.0
113	18-19	43.1	42.3	4.0	4.4	1.7
114	19-20	25.1	25.7	16.5	17.8	15.3
115	20-21	0.6	10.6	82.0	75.8	64.5
116	21-22	2.4	35.9	61.8	78.8	102.2†
117	22-23	27.6	23.1	17.8	13.0	10.2
	23-24	27.6	23.1	17.8	13.0	10.2
118	24-25	0.7	1.4	16.1	19.1	16.6
119	25-26	7.4	10.3	9.0	8.2	7.0†
120	26-27	15.4	30.2	6.8	6.6	4.2
	27-28	15.4	30.2	6.8	6.6	4.2
121	28-29	16.5	27.3	4.3	1.1	1.6
Arithmetic Mean N=28 (21)		24.8	33.9	28.9	(34.7)	25.6
Maximum		79.4	104.5	82.0	78.8	102.2
Minimum		0.6	1.4	2.0	1.1	1.0
No. of results above 10 $\mu g/m^3$		22	27	21	14	19
No. of results above 50 $\mu g/m^3$		2	4	7	5	2
No. of results above 100 $\mu g/m^3$		-	1	-	-	1

* In $\mu g/m^3$, 1 to 29 April 1972
† Filter not exchanged

TABLE A-51. ATMOSPHERIC LEAD CONCENTRATIONS IN MEZA VALLEY*

Number	Date	Mezice (VI)	Zerjav (III)	Rudarjevo (I)	Crna SE (V)	Crna W (II)
122	3-4 May	4.7	16.3	4.5	4.7	3.4
123	4-5	7.9	15.0	1.3	13.9	10.0
124	5-6	7.2	22.1	14.5	2.0	0.9†
125	6-7	14.7	35.5	5.3	5.4	2.7†
	7-8	14.7	35.5	5.3	5.4	2.7
126	8-9	15.2	12.8	7.4	6.4	2.1†
127	9-10	10.3	25.7	17.4	13.6	11.3†
	10-11	10.3	25.7	17.4	13.6	11.3
128	11-12	14.7	35.0	6.6	5.3	3.7
129	12-13	12.5	13.5	18.0	33.4	23.4†
130	13-14	8.8	32.0	25.8	20.6	12.6†
	14-15	8.8	32.0	25.8	20.6	12.6
131	15-16	13.3	51.6	10.0	3.2	2.1
132	16-17	15.8	26.8	20.3	15.8	12.4
133	17-18	17.7	17.4	19.4	21.6	15.5
134	18-19	13.3	17.6	49.0	22.7	41.5
135	19-20	34.4	40.2	3.4	17.0	1.3†
136	20-21	10.0	25.4	30.0		17.8†
	21-22	10.0	25.4	30.0		17.8
137	22-23	33.1	31.2	31.2	35.1	23.1
138	23-24	44.8	39.4	26.8	29.4	16.5
139	24-25	14.3	27.8	17.2	17.5	11.6
140	25-26	20.3	37.8	11.5	10.4	8.7
141	26-27	24.4	36.1	12.7	10.7	8.6†
142	27-28	13.4	40.8	5.8	6.3	4.4†
	28-29	13.4	40.8	5.8	6.3	4.4
143	29-30	24.9	21.1	12.4	9.7	4.6
144	30-31	20.6	22.3	1.1	0.7	0.5
145	31 May-1 June	5.0	13.5	10.7	12.6	7.1
Arithmetic Mean N=29 (27)		15.8	28.1	15.4	(13.5)	10.2
Maximum		45	51.6	49.0	35.1	41.5
Minimum		5	12.8	1.1	0.7	0.9
No. of results above 10 $\mu g/m^3$		21	29	18	16	13
No. of results above 50 $\mu g/m^3$		-	1	-	-	-
No of results above 100 $\mu g/m^3$		-	-	-	-	-

* In $\mu g/m^3$, 3 May to 1 June 1972
† Filter not exchanged

TABLE A-52. ATMOSPHERIC LEAD CONCENTRATIONS IN MEZA VALLEY*

Number	Date	Mezice (VI)	Zerjav (II)	Rudarjevo (I)	Crna SE (V)	Crna W (II)
146	1-2 June	0.2	1.4	35.1	39.2	32.2
147	2-3	0.1	0.4	13.8	24.4	18.4†
148	3-4	14.4	14.6	16.2	9.5	9.8†
	4-5	14.4	14.6	16.2	9.5	9.8
149	5-6	33.6	45.9	5.9	4.2	3.4
150	6-7	13.9	14.5	8.2	4.2	4.0
151	7-8	14.3	15.3	3.8	5.8	3.6
152	8-9	2.2	2.9	63.3	37.8	32.8†
153	9-10	22.6	24.3	13.1	10.1	9.0†
	10-11	22.6	24.3	13.1	10.1	9.0
154	11-12	25.0	28.6	0.5	0.2	0.2
155	12-13	9.8	26.6	7.6	3.4	3.7
156	13-14	27.6	37.6	15.5	13.6	9.7
157	14-15	10.7	19.2	10.0	9.1	6.4
158	15-16	16.9	18.8	7.2	4.1	6.4
159	16-17	3.8	16.0	8.8	5.4	3.7†
160	17-18	6.3	12.0	23.5	20.4	15.1†
	18-19	6.3	12.0	23.5	20.4	15.1
161	19-20	25.2	43.1	15.4	9.1	9.5
162	20-21	11.9	38.2	4.7	1.1	1.1
163	21-22	27.6	21.0	22.9	13.7	13.5
164	22-23	69.0	38.5	12.4	11.6	11.0
165	23-24	2.6	7.0	15.5	19.1	13.8
166	24-25	17.9	18.0	25.3	9.9	9.0†
167	25-26	37.8	21.4	9.4	17.3	15.2†
	26-27	37.8	21.4	9.4	17.3	15.2
168	27-28	15.4	26.6	41.5	4.8	6.1
169	28-29	22.2	28.2	16.2	14.6	11.2
170	29-30	15.0	27.7	44.4	29.0	26.2
171	30 June-1 July	6.8	20.8	39.3	16.4	17.7
Arithmetic Mean N=30		17.8	21.4	18.1	13.2	11.4
Maximum		69.0	45.9	63.3	39.2	32.8
Minimum		0.1	0.4	0.5	0.2	0.2
No. of results above 10 $\mu g/m^3$		21	26	19	16	13
No. of results above 50 $\mu g/m^3$		1	-	1	-	-
No. of results above 100 $\mu g/m^3$		-	-	-	-	-

* In $\mu g/m^3$, 1 June to 1 July 1972
† Filter not exchanged

TABLE A-53. ATMOSPHERIC LEAD CONCENTRATIONS IN MEZA VALLEY*

Number	Date	Mezice (VI)	Zerjav (III)	Rudarjevo (I)	Crna SE (V)	Crna W (II)
172	1-2 July	7.6	9.9	3.3	1.0	1.2†
	2-3	7.6	9.9	3.3	1.0	1.2†
173	3-4	0.9	1.2	0.5	0.1	0.2†
	4-5	0.9	1.2	0.5	0.1	0.2
174	5-6	6.0	13.4	3.0	2.6	1.7
175	6-7	6.3	15.6	2.5	2.1	1.9
176	7-8	10.0	7.4	10.9	8.6	9.5†
177	8-9	5.3	7.3	3.9	1.9	2.5†
	9-10	5.3	7.3	3.9	1.9	2.5†
178	10-11	0.3	1.8	27.2	20.5	21.7†
	11-12	0.3	1.8	27.2	20.5	21.7
179	12-13	0.2	1.9	16.8	5.6	6.1
180	13-14	0.2	1.2	28.7	24.4	21.2
181	14-15	14.5	0.3	67.9	42.2†	41.3
182	15-16	1.6	18.9	31.8	22.0†	
	16-17	1.6	18.9	31.8	22.0	
183	17-18	12.1	25.4	18.9	13.7	
184	18-19	14.7	28.7	13.8	7.9	
185	19-20	23.5	35.8	11.0	15.9	
186	20-21	11.4	29.4	17.3	11.2	
187	21-22	21.2	18.1	29.6	1.4	
188	22-23	33.1	25.0	17.8	10.0	27.1†
	23-24	33.1	25.0	17.8	10.0	27.1
189	24-25	26.7	20.1	3.7	6.7	4.4†
190	25-26	12.9	26.4	7.8	7.5	3.9†
	26-27	12.9	26.4	7.8	7.5	3.9
191	27-28	14.8	22.6	6.7	5.0	4.8
192	28-29	21.0	22.1	34.5	28.7	30.3†
193	29-30	22.6	27.8	21.6	18.0	14.6†
	30-31	22.6	27.8	21.6	18.0	14.6
194	31 July-1 Aug.	17.1	32.7	20.8	11.4	9.0
Arithmetic Mean N=31 (24)		11.9	16.5	16.6	11.3	(11.4)
Maximum		33.1	35.8	67.9	42.2	41.3
Minimum		0.2	0.3	0.5	0.1	0.2
No. of results above 10 $\mu g/m^3$		17	19	19	15	9
No. of results above 50 $\mu g/m^3$		-	-	1	-	-
No of results above 100 $\mu g/m^3$		-	-	-	-	-

* In $\mu g/m^3$, 1 July to 1 August 1972
† Filter not exchanged

TABLE A-54. ATMOSPHERIC LEAD CONCENTRATIONS IN MEZA VALLEY*

Number	Date	Mezice (VI)	Zerjav (III)	Rudarjevo (I)	Crna SE (V)	Crna W (II)
195	1-2 August	30.5	48.5	10.2	10.5	7.2
196	2-3	25.0	23.3	5.2	2.7	4.0
197	3-4	25.1	19.6	12.2	11.0	11.4
198	4-5	23.0	33.0	28.3	25.0	16.0†
199	5-6	35.6	27.3	12.3	11.3	11.0†
	6-7	35.6	27.3	12.3	11.3	11.0
200	7-8	23.7	20.0	9.6	13.8	8.2
201	8-9	9.5	4.6	12.1	11.4	8.4
202	9-10	8.6	5.7	8.1	7.8	5.7
203	10-11	25.8	39.8	13.8	13.7	10.6
204	11-12	33.8	15.7	17.9	15.0	10.6
205	12-13	14.8	17.5	5.8	11.0	7.0
	13-14	14.8	17.5	5.8	11.0	7.0
206	14-15	14.4	17.3	8.7	10.6	8.1
207	15-16	12.6	10.6	7.4	7.1	6.0
208	16-17	20.7	22.6	6.8	4.8	2.6
209	17-18	15.0	19.5	18.4	13.5	11.7
210	18-19	0.7	15.6	0.8	0.2	0.1†
211	19-20	0.2	4.2	0.6	0.2	0.1†
	20-21	0.2	4.2	0.6	0.2	0.1
212	21-22	4.9	10.6	0.7	1.1	0.5
213	22-23	14..6	16.6	8.3	7.6	4.4
214	23-24	14.7	8.2	12.6	8.9	8.6
215	24-25	18.0	11.6	9.1	5.0	5.7
216	25-26	21.4	16.3	10.6	7.6	4.2†
217	26-27	11.9	15.0	5.8	5.1	3.0†
	27-28	11.9	15.0	5.8	5.1	3.0
218	28-29	13.7	6.5	22.3	22.4	17.6
219	29-30	1.5	11.2	20.9	14.5	8.4
220	30-31	7.6	26.7	2.8	3.1	2.6
221	31 Aug.- 1 Sept.	14.8	12.8	5.3	6.9	4.9
Arithmetic Mean N=31		16.2	17.6	9.7	9.0	6.8
Maximum		35.6	48.5	28.3	25.0	17.6
Minimum		0.2	4.2	0.6	0.2	0.1
No. of results above 10 $\mu g/m^3$		23	25	13	15	8
No. of results above 50 $\mu g/m^3$		-	-	-	-	-
No. of results above 100 $\mu g/m^3$		-	-	-	-	-

* In $\mu g/m^3$, 1 August to 1 September 1972
† Filter not exchanged

TABLE A-55. ATMOSPHERIC LEAD CONCENTRATIONS IN MEZA VALLEY*

Number	Date	Merzice (VI)	Zerjav (III)	Rudarjevo (I)	Crna SE (V)	Crna W (II)
222	1-2 September	6.7	8.4	13.7	17.6	11.3
223	2-3	16.5	11.7	11.4	10.5	7.8†
	3-4	16.5	11.7	11.4	10.5	7.8
224	4-5	19.9	22.5	22.3	10.8	9.5
225	5-6	21.1	21.2	17.1	15.5	12.6
226	6-7	52.9	57.0	19.0	17.5	12.1
227	7-8	22.3	21.8	37.5	30.6	21.2
228	8-9	21.5	6.8	17.1	18.9	16.8
229	9-10	9.9	10.6	43.4	34.1	26.3†
	10-11	9.9	10.6	43.4	34.1	26.3
230	11-12	48.7	41.7	45.8	35.0	21.7
231	12-13	12.6	10.9	26.7	21.9	16.7
232	13-14	28.1	22.5	36.1	23.2	20.0
233	14-15	22.1	23.8	4.7	2.9	1.9
234	15-16	0.4	27.0	42.3	37.4	33.6
235	16-17	6.5	23.9	29.8	24.9	22.4†
	17-18	6.5	23.9	29.8	24.9	22.4
236	18-19	3.0	8.2	25.2	16.3	13.7
237	19-20	1.5	12.6	38.4	38.4	32.8
238	20-21	14.9	19.3	18.2	14.8	12.0
239	21-22	8.6	11.9	9.9	3.3	5.6
240	22-23	22.4	22.2	12.9	10.3	9.8
241	23-24	6.5	2.1	20.0	2.3	2.1†
	24-25	6.5	2.1	20.0	2.3	2.1
242	25-26	15.6	8.1	9.2	3.9	1.5
243	26-27	8.8	7.6	18.9	16.5	11.2
244	27-28	23.0	17.3	18.1	12.0	10.0
245	28-29	26.6	43.6	11.3	7.1	5.2
246	29-30	20.0	33.3	17.5	10.3	16.8
247	30 Sept.-1 Oct.	4.0	7.6	14.4	1.9	3.2†
	1-2	4.0	7.6	14.4	1.9	3.2
Arithmetic Mean N=31		15.7	18.0	22.6	16.5	13.5
Maximum		52.9	57.0	45.8	38.4	33.6
Minimum		0.4	2.1	4.7	1.9	1.5
No. of results above 10 $\mu g/m^3$		17	22	28	23	18
No. of results above 50 $\mu g/m^3$		1	1	-	-	-
No. of results above 100 $\mu g/m^3$		-	-	-	-	-

* In $\mu g/m^3$, 1 September to 2 October 1972
† Filter not exchanged

TABLE A-56. ATMOSPHERIC LEAD CONCENTRATIONS IN MEZA VALLEY*

Number	Date	Mezice (VI)	Zerjav (III)	Rudarjevo (I)	Crna SE (V)	Crna W (II)
248	2-3 October	1.8	5.7	8.1	10.7	16.2
249	3-4	0.5	0.7	7.3	4.9	4.4
250	4-5	15.6	26.9	37.5	19.3	16.1
251	5-6	24.8	41.8	35.1	29.8	21.0
252	6-7	9.1	33.9	4.2	3.1	2.7†
253	7-8	2.8	21.7	25.3	28.6	26.1†
	8-9	2.8	21.7	25.3	28.6	26.1
	9-10	2.8	21.7	25.3	28.6	26.1
254	10-11	34.5	20.6	27.0	29.1	22.4
255	11-12	28.3	41.6	27.6	34.1	29.9
256	12-13	32.1	36.9	61.0	28.5	14.4
25	13-14	8.0	66.4	13.0	3.5	2.8†
25	14-15	24.4	9.6	20.9	8.6	11.5†
	15-16	24.4	8.6	20.9	8.6	11.5
259	16-17	21.4	18.7	44.5	21.0	27.6
260	17-18	22.6	14.9	60.1	7.4	27.2
261	18-19	5.1	27.9	9.9	43.6	5.0
262	19-20	15.7	29.5	27.0	25.7	15.2
263	20-21	32.0	30.8	18.5	13.5	13.2†
264	21-22	16.6	25.9	20.9	13.8	11.4†
	22-23	16.6	25.9	20.9	13.8	11.4
265	23-24	34.4	69.2	46.1	27.5	24.0
266	24-25	36.4	16.1	42.9	21.2	16.7
267	25-26	60.6	42.0	73.5	41.6	28.3
268	26-27	63.7	68.2	62.3	31.0	29.9
269	27-28	9.3	9.0	64.7	47.5	30.7†
270	28-29	5.9	17.0	47.0	42.8	36.2†
	29-30	5.9	17.0	47.0	42.8	36.2
271	30-31	96.3	33.3	82.7	100.1	48.4†
272	31 Oct.-1 Nov.	75.2	67.6	49.5	33.0	39.4†
	1-2	75.2	67.6	49.5	33.0	39.4
Arithmetic Mean N=31		26.0	30.2	35.7	26.6	21.7
Maximum		96.3	69.2	82.7	100.1	48.4
Minimum		0.5	0.7	4.2	3.1	2.7
No. of results above 10 $\mu g/m^3$		20	26	27	25	27
No. of results above 50 $\mu g/m^3$		5	5	6	1	-
No. of results above 100 $\mu g/m^3$		-	-	-	1	-

* In $\mu g/m^3$, 2 October to 2 November 1972
† Filter not exchanged

TABLE A-57. ATMOSPHERIC LEAD CONCENTRATIONS IN MEZA VALLEY*

Number	Date	Mezice (VI)	Zerjav (III)	Rudarjevo (I)	Crna SE (V)	Crna W (II)
273	2-3 November	47.8	23.0	95.4	32.0	52.1
274	3-4	49.2	17.6	41.8	37.1	29.6†
275	4-5	25.1	15.6	82.9	53.1	43.6
	5-6	25.1	15.6	82.9	53.1	43.6
276	6-7	23.9	18.3	62.5	58.4	25.1
277	7-8	48.2	46.9	2.7	59.1	40.6
278	8-9	35.4	31.6		29.1	20.4
279	9-10	46.2	30.7		63.3	54.0
280	10-11	86.4	75.5	166.4	106.9	98.6†
281	11-12	14.8	29.3	61.4	55.1	48.3
	12-13	14.8	29.3	61.4	55.1	48.3
282	13-14	50.0	18.8	36.1	36.3	30.7
283	14-15	1.5	8.6	72.2	59.3	50.5
284	15-16	15.0	64.6	62.3	46.2	39.3
285	16-17	39.9	54.0	12.7	6.0	6.2
286	17-18	37.3	59.9	42.1	20.7	15.2†
287	18-19	28.9	61.6	82.3	38.0	28.6
	19-20	28.9	61.6	82.3	38.0	28.6
288	20-21	7.1	29.3	164.8	105.0	78.0
289	21-22	4.8	59.4	199.0	144.3	88.2
290	22-23	4.9	19.6	134.8	134.5	81.9
291	23-24	5.9	26.1	58.9	69.7	52.3
292	24-25	0.8	14.9	36.1	39.3	15.7†
293	25-26	12.9	22.2	39.5	30.8	23.1
	26-27	12.9	22.2	39.5	30.8	23.1
294	27-38	34.3	25.1	39.2	30.8	21.8
Arithmetic Mean N=26 (24)		27.0	33.9	73.3	55.1	41.8
Maximum		86.4	75.5	199.0	144.3	98.6
Minimum		0.8	8.6	2.7	6.0	6.2
No. of results above 10 $\mu g/m^3$		20	25	23	25	25
No. of results above 50 $\mu g/m^3$		1	7	15	13	8
No. of results above 100 $\mu g/m^3$		-	-	4	4	-

* In $\mu g/m^3$, 2 November to 28 November 1972
† Filter not exchanged

APPENDIX B

BIOLOGICAL DATA

Cumulative Frequency Distribution of Biological Parameters

In the series of 28 figures which follow, each of the biological parameters is analyzed as a function of the area or occupation (or both) of the groups or subgroups of subjects studied.

Relationship of Lead in Air to Biological Parameters

The four main groups of tables in this appendix show the relationship of the concentration of lead in the air to the following variables:

1. Rural Area of residence

    a. Bohinjska Bela
    b. Bovec
    c. Tolmin

2. Urban Area by occupation

    a. Postman
    b. Gas station employee
    c. Streetcar driver
    d. Customs officer
    e. Traffic policeman

3. Residence in a lead smeltery area

    a. Meza Valley inhabitant with no occupational exposure
    b. Working close to the lead smeltery or having previous occupational exposure

4. Occupational exposure due to employment in one of the following:

    a. Lead article manufacturing plant
    b. Lead storage battery manufacturing in the Munja II or Munja I plant
    c. Lead smelting plant

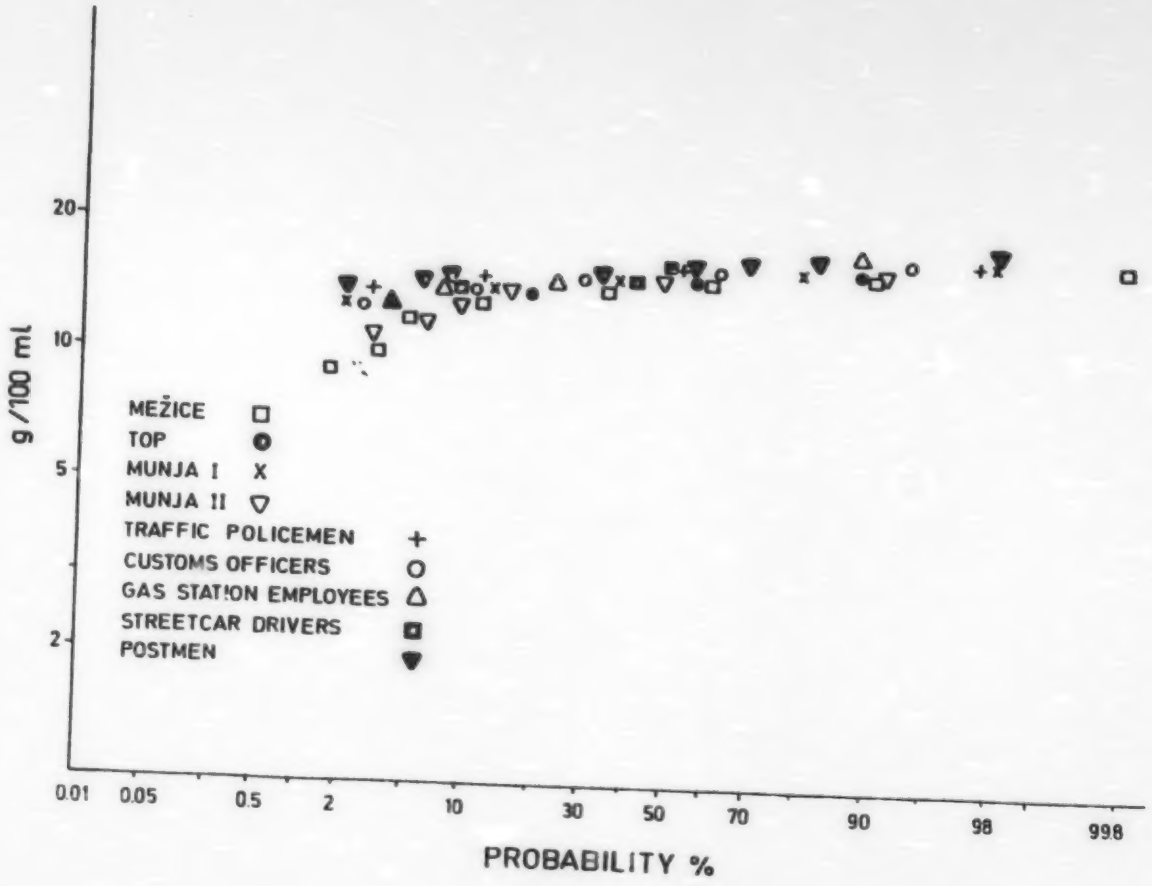

Figure B-1. Haemoglobin - cumulative frequency distribution.

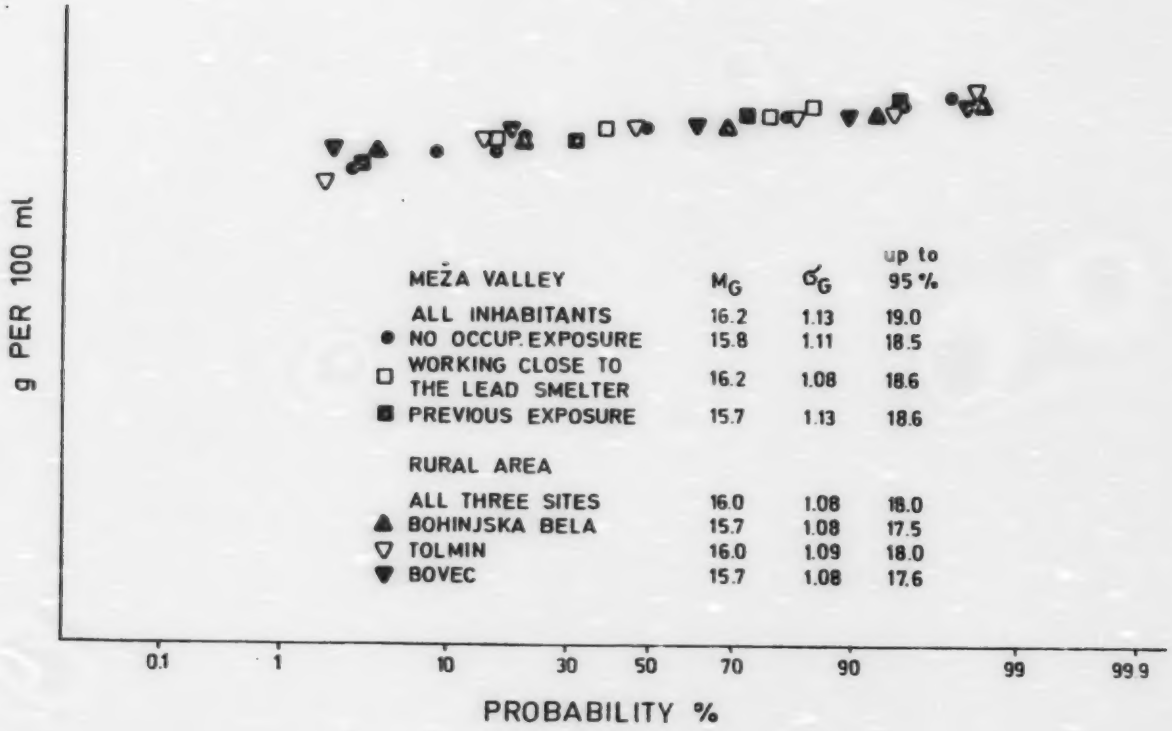

Figure B-2. Haemoglobin - cumulative frequency distribution.

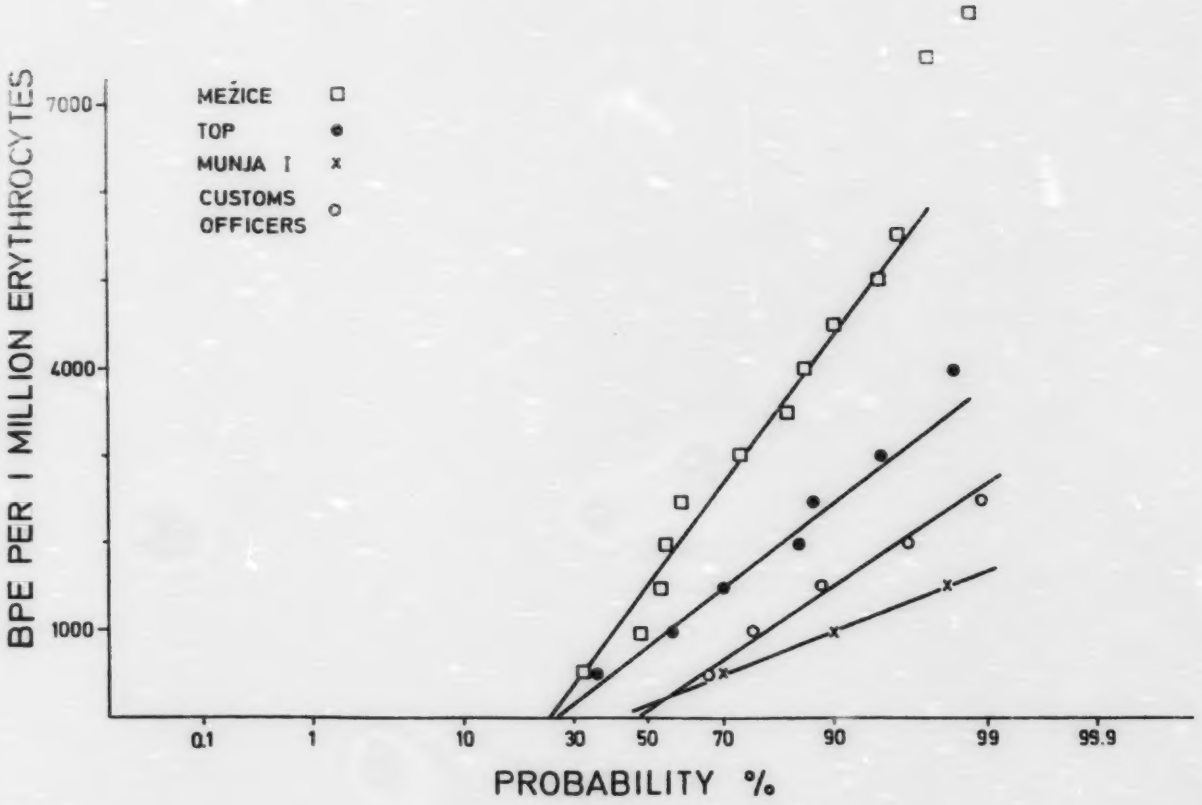

Figure B-3. BPE - cumulative frequency distribution.

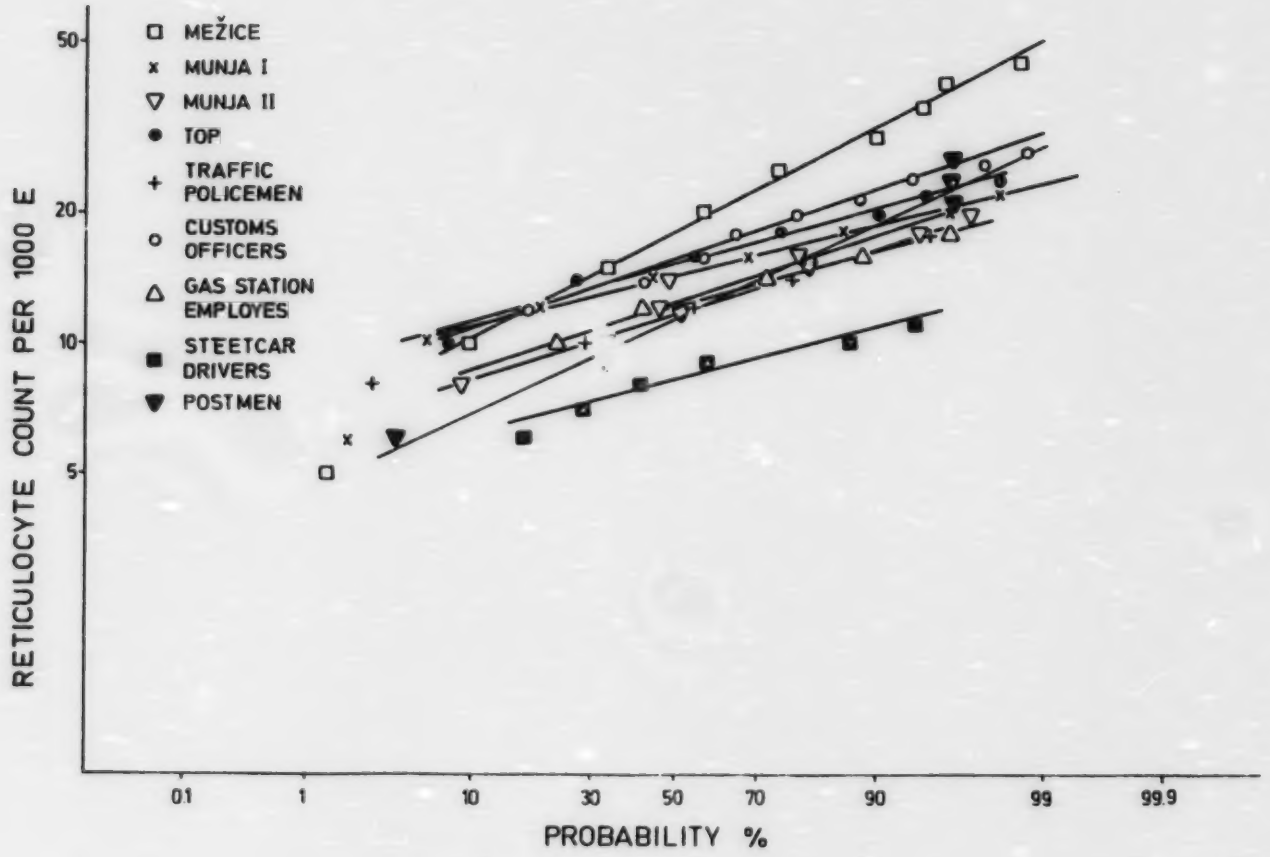

Figure B-4. Reticulocyte count - cumulative frequency distribution.

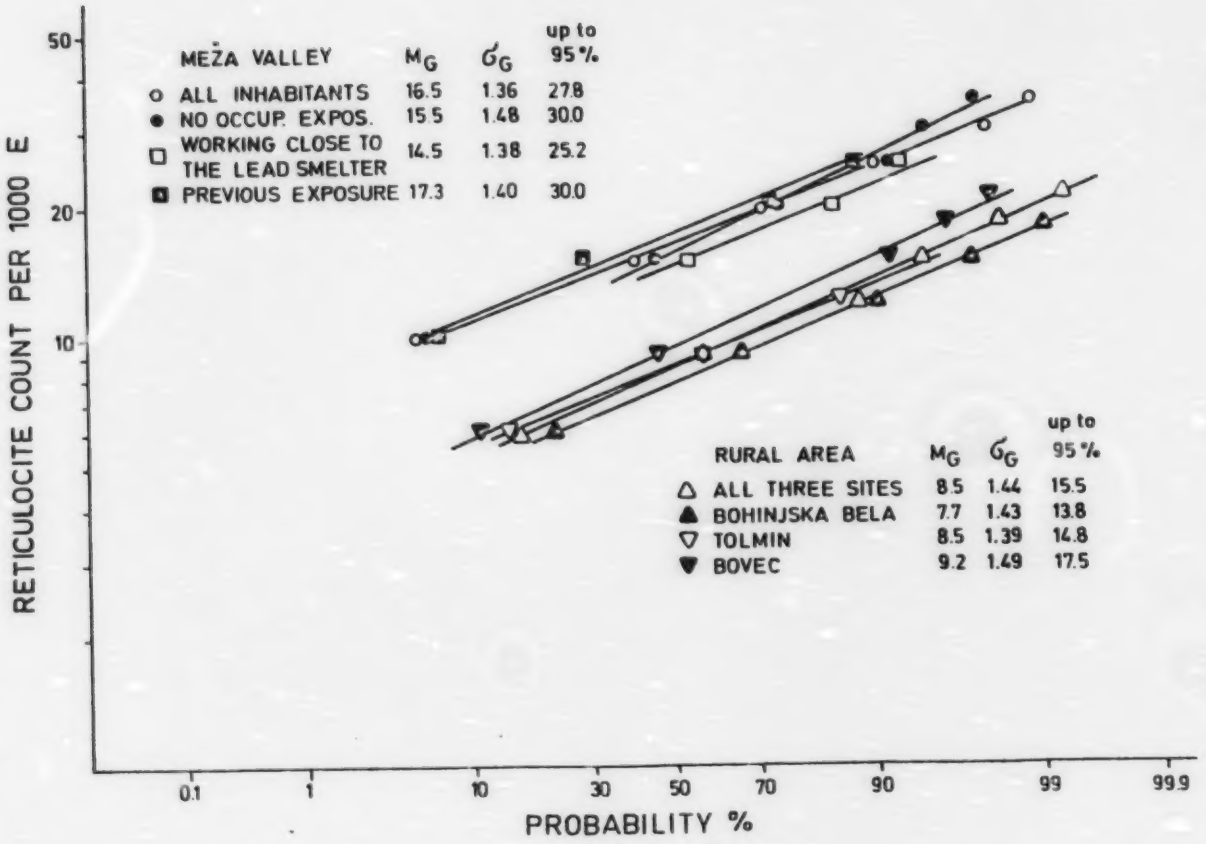

Figure B-5. Reticulocyte count - cumulative frequency distribution.

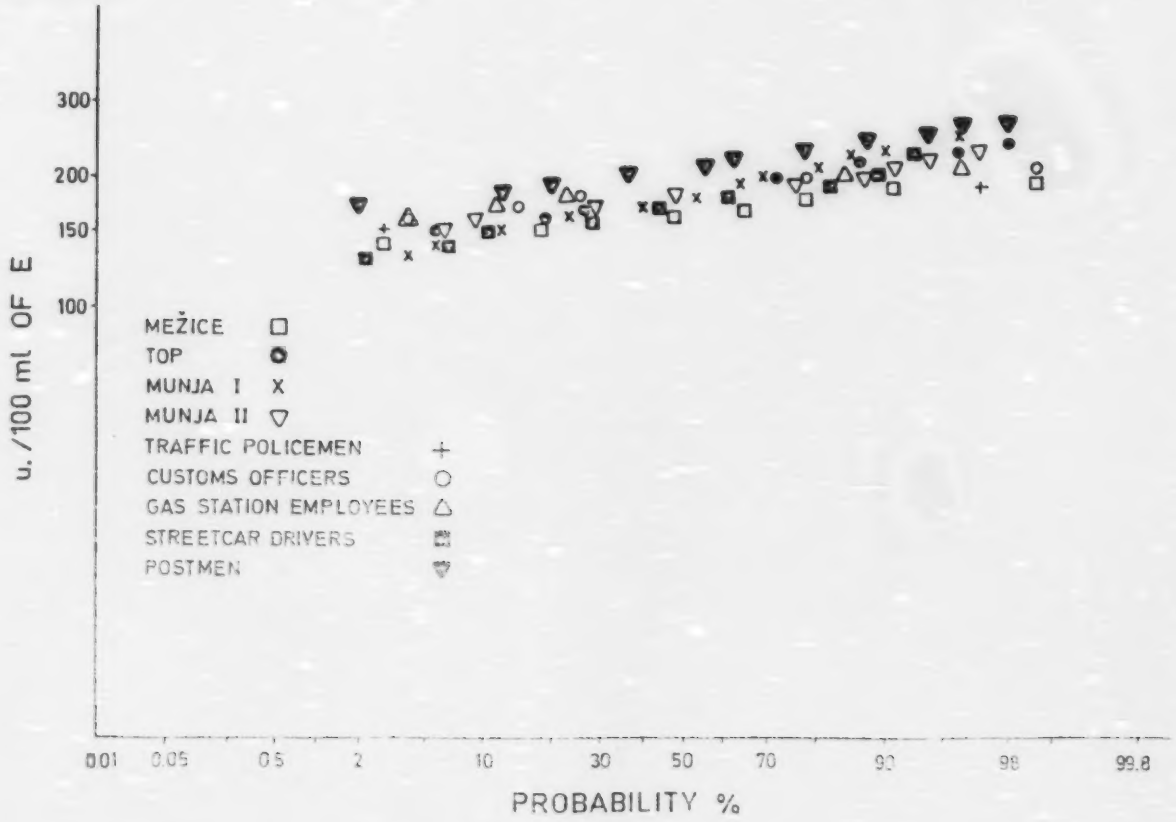

Figure B-6. G-6-PD - cumulative frequency distribution.

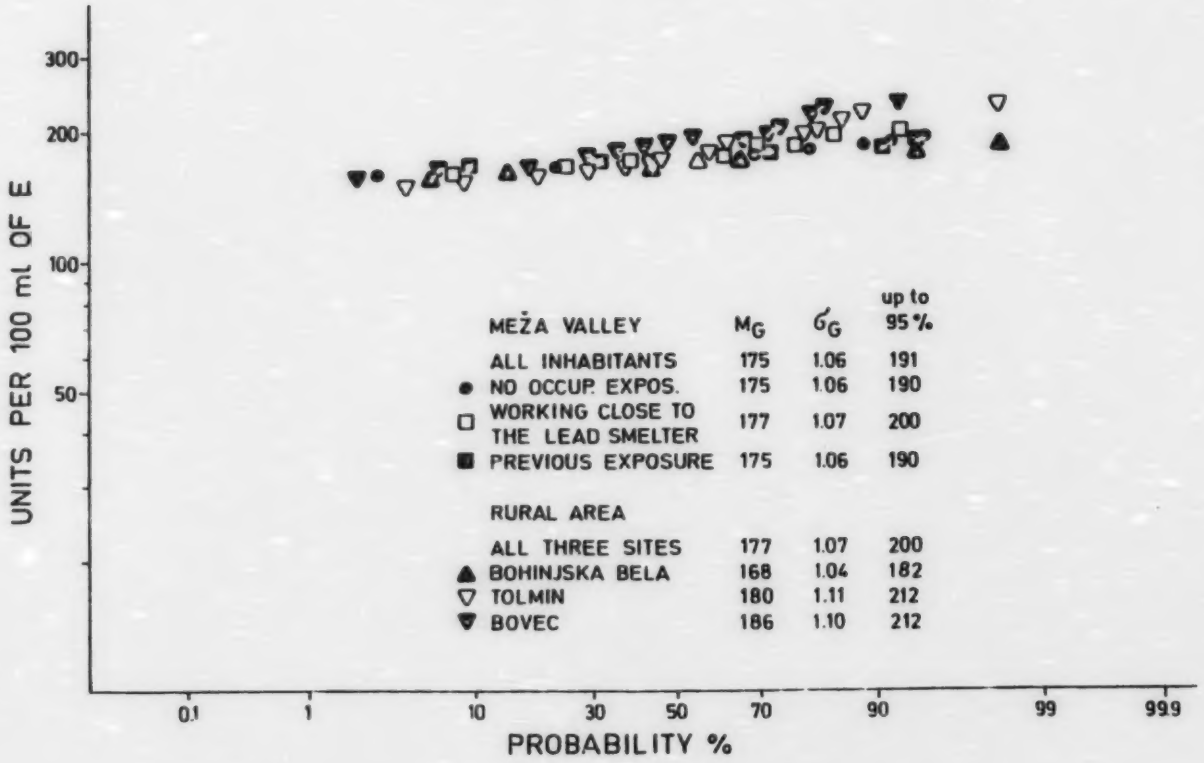

Figure B-7. G-6-PD - cumulative frequency distribution.

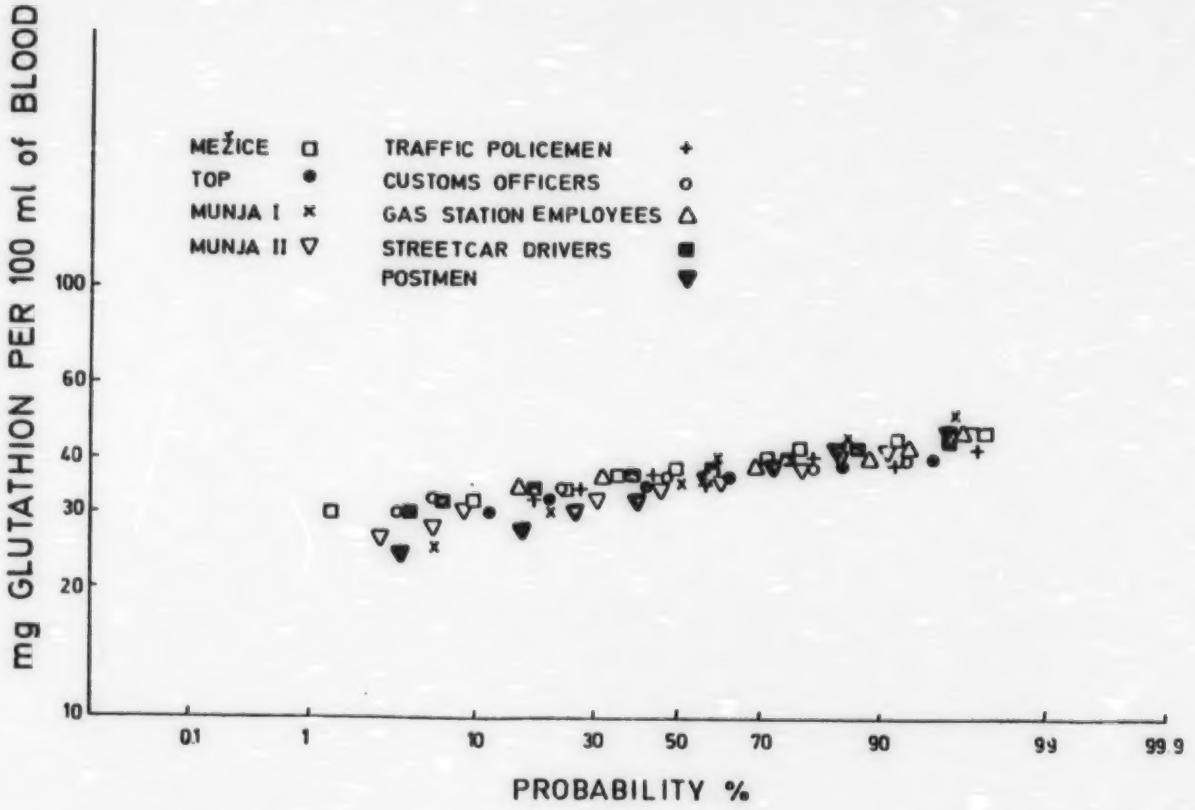

Figure B-8. Glutathion - cumulative frequency distribution.

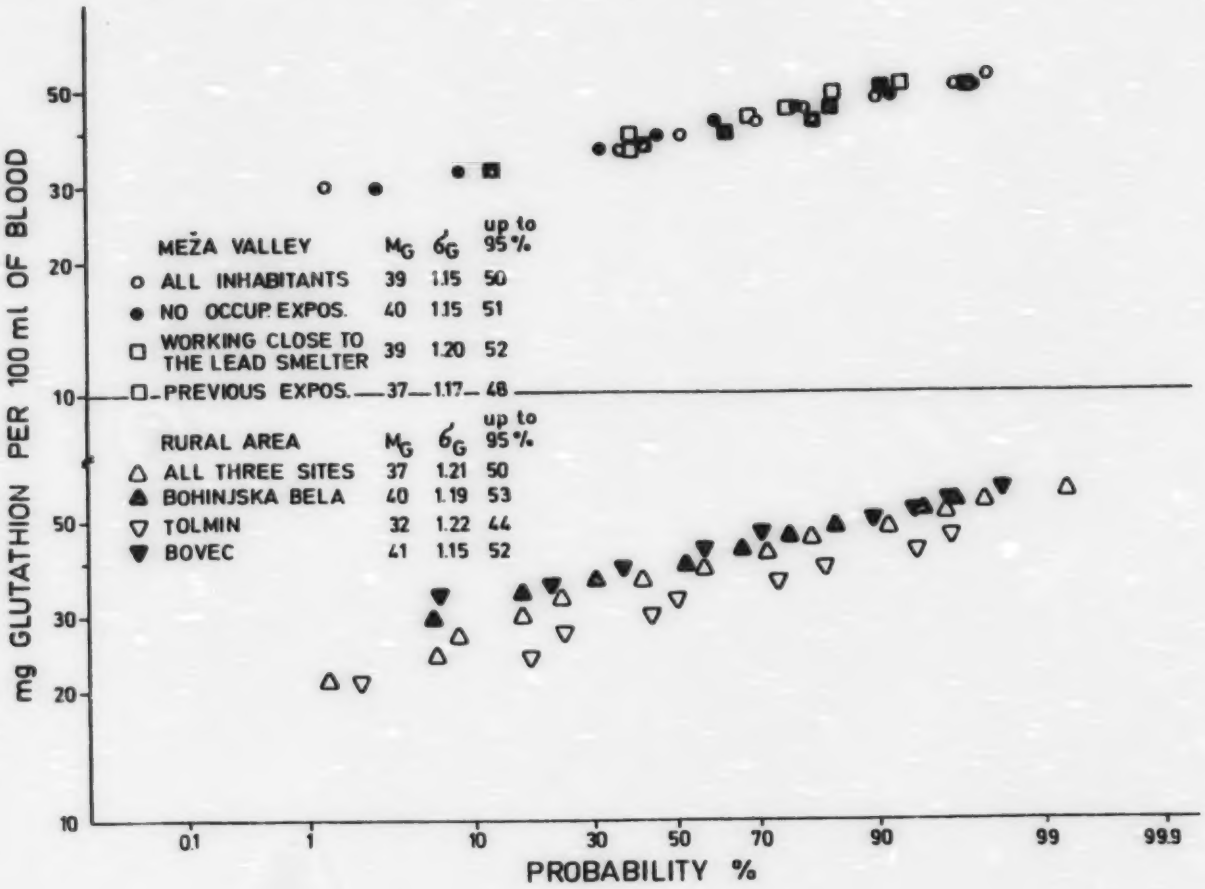

Figure B-9. Glutathion - cumulative frequency distribution.

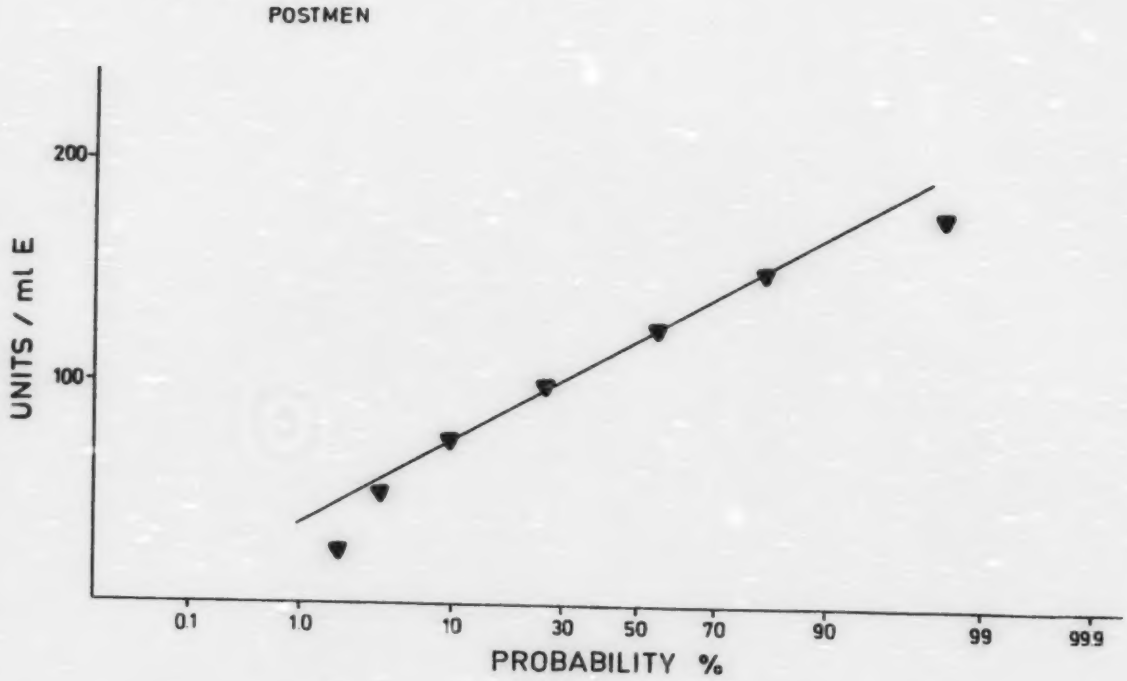

Figure B-10. ALAD - cumulative frequency distribution.

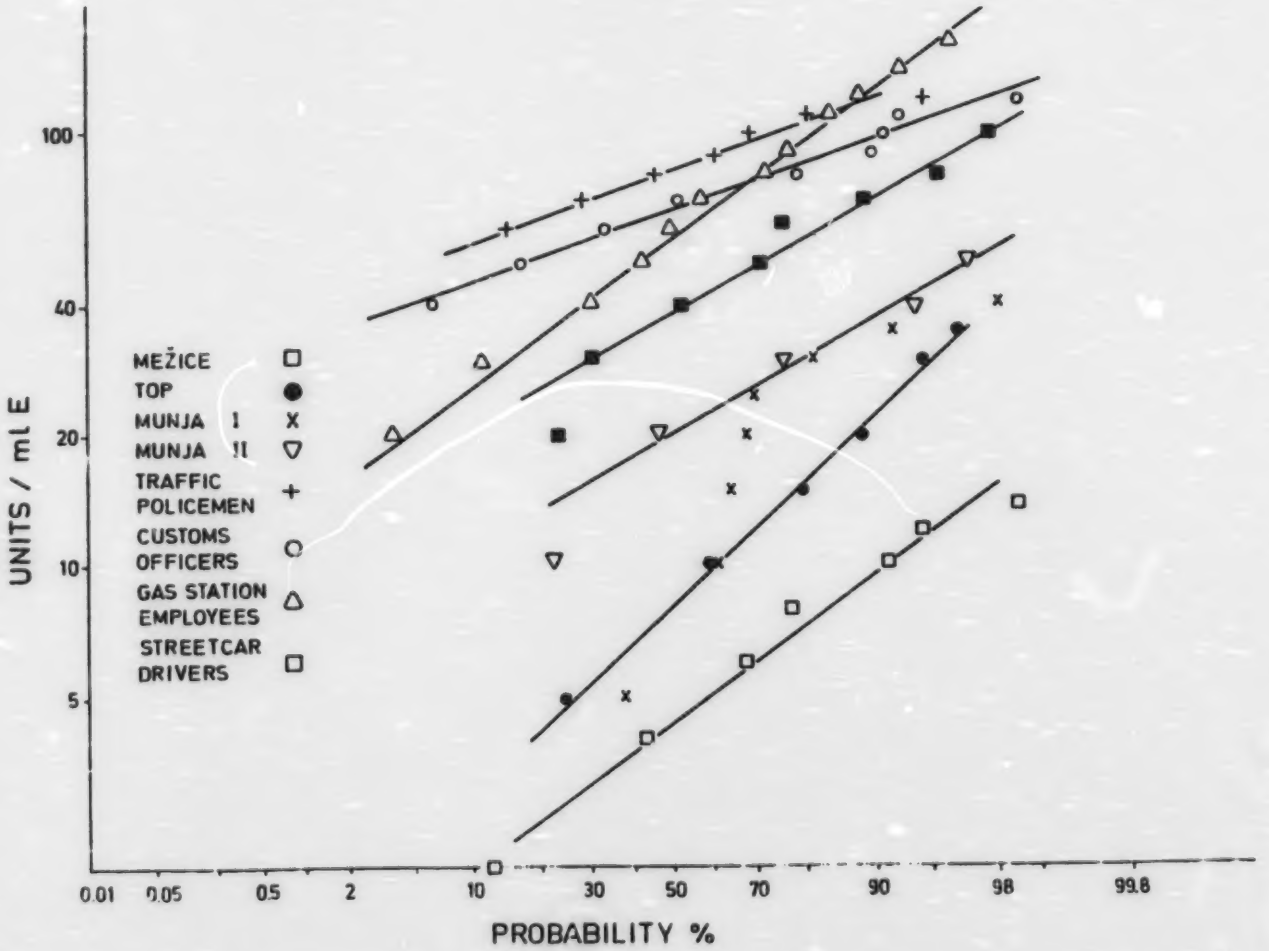

Figure B-11. ALAD - cumulative frequency distribution.

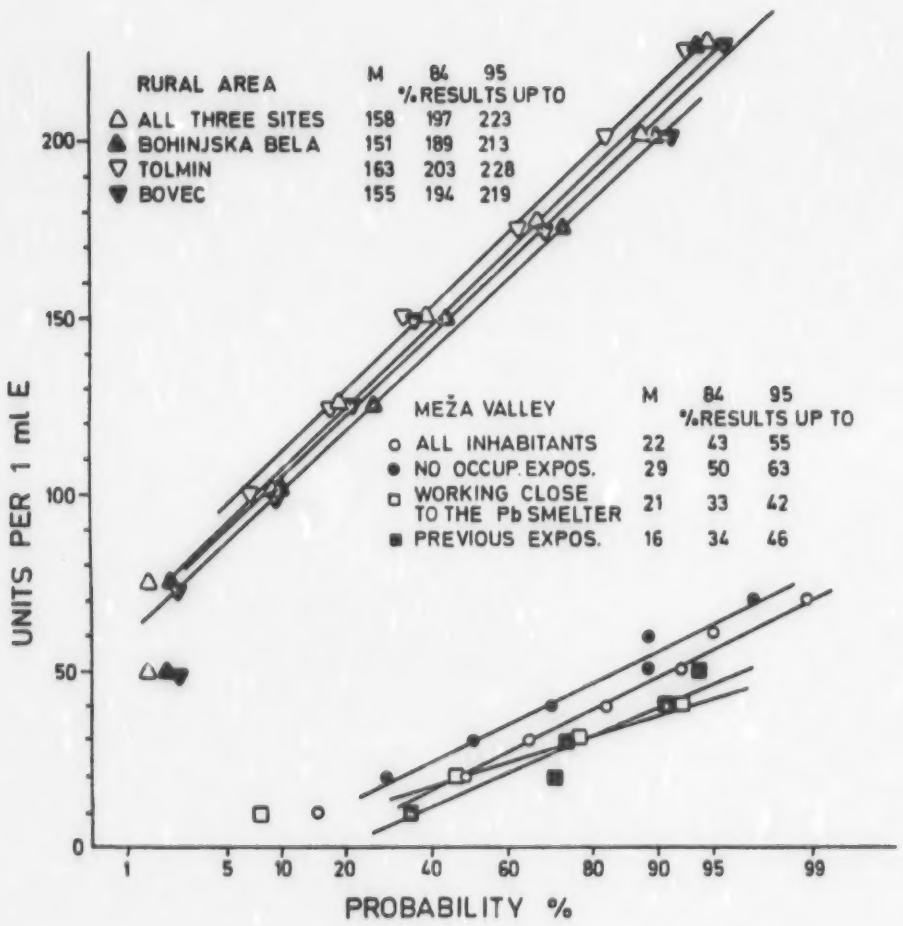

Figure B-12. ALAD - cumulative frequency distribution.

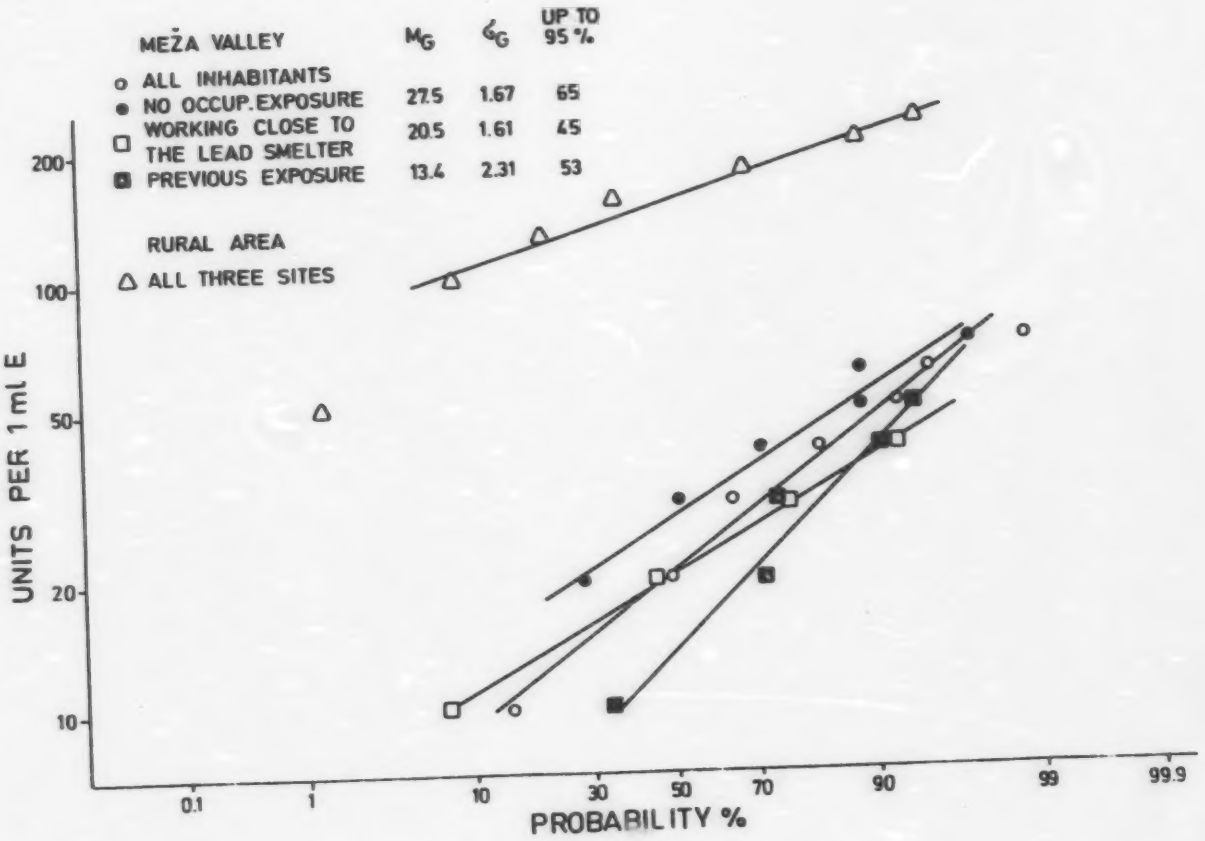

Figure B-13. ALAD - cumulative frequency distribution.

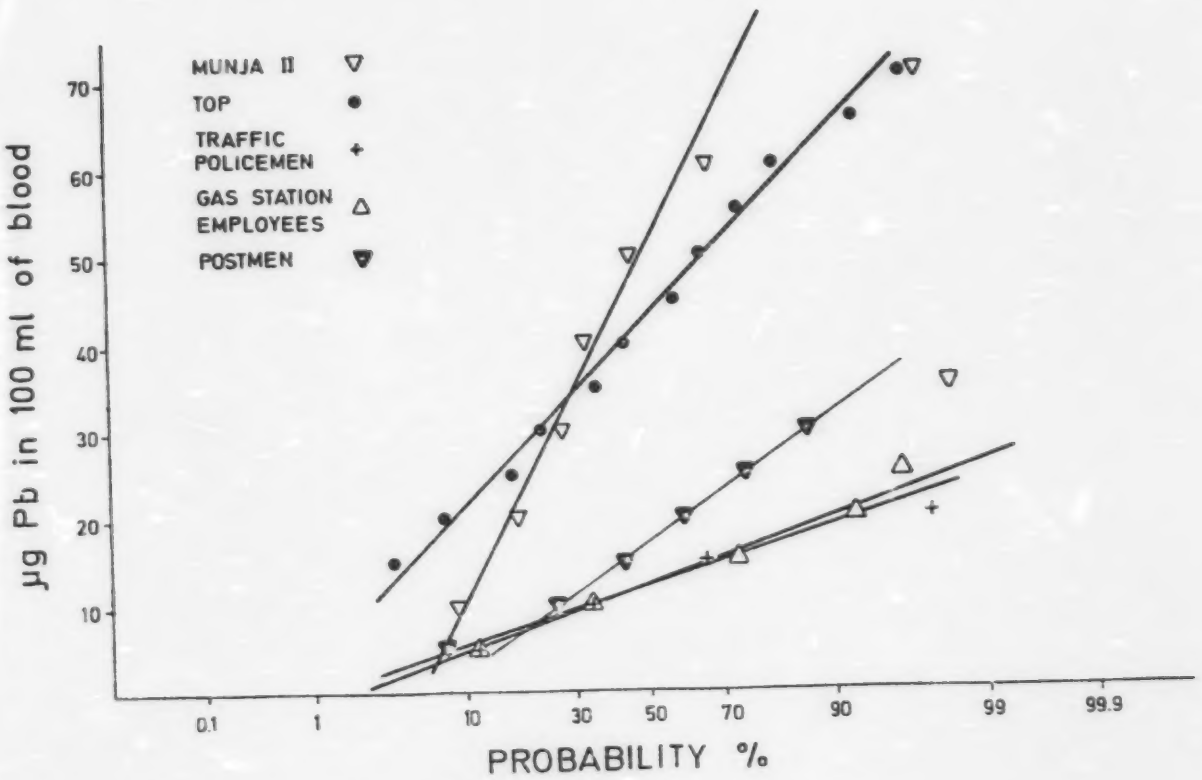

Figure B-14. Lead in blood - cumulative frequency distribution.

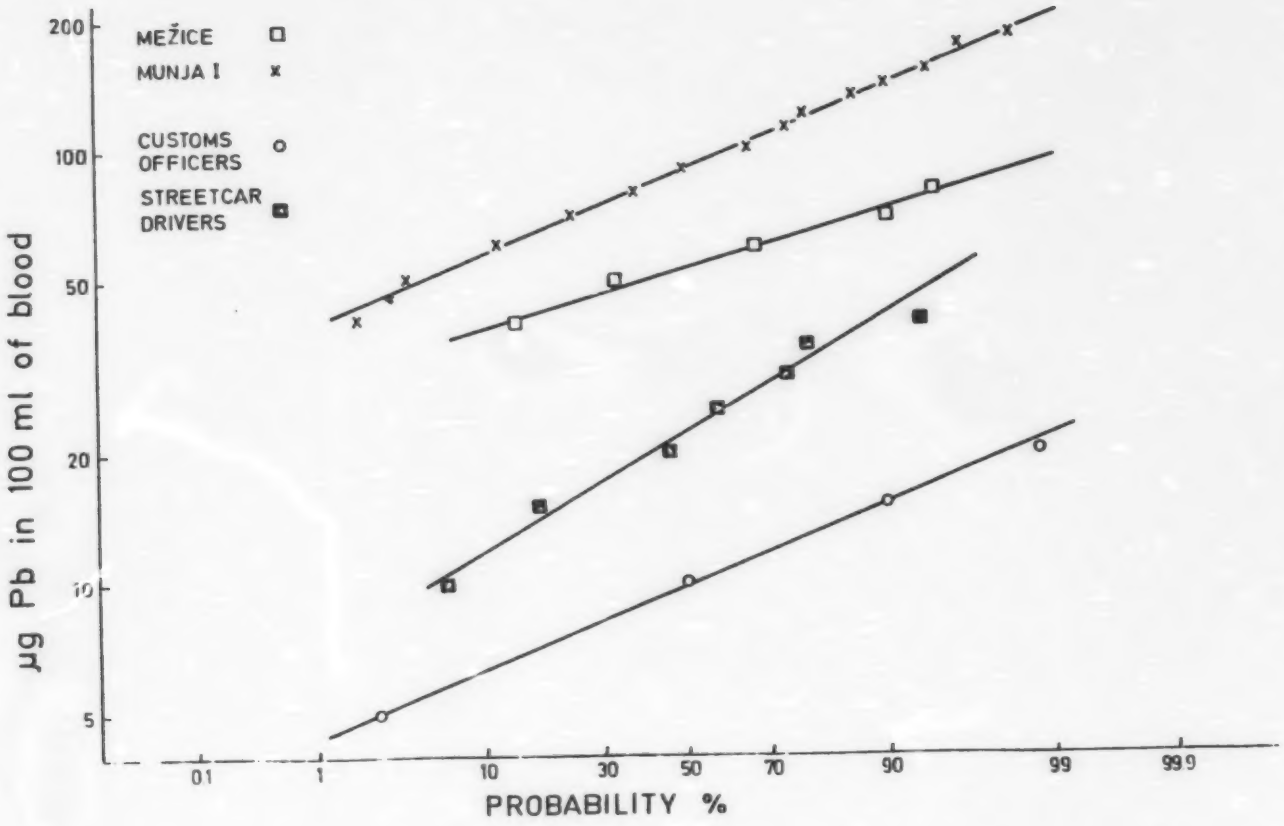

Figure B-15. Lead in blood - cumulative frequency distribution.

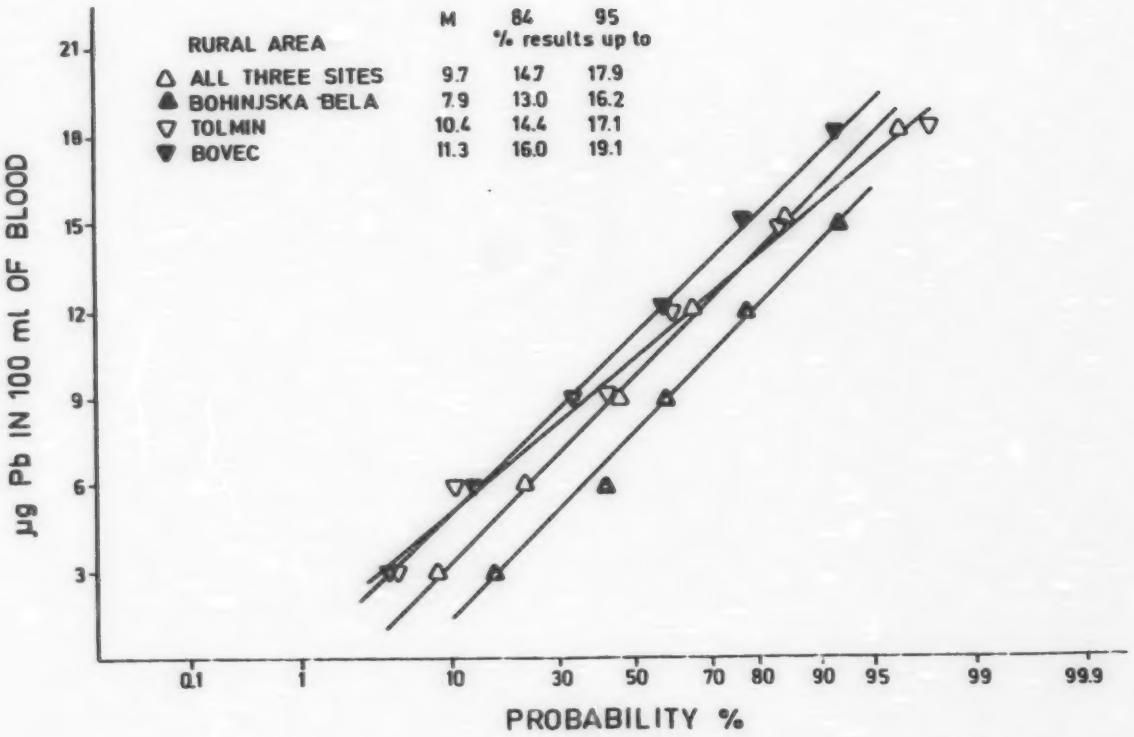

Figure B-16. Lead in blood - cumulative frequency distribution.

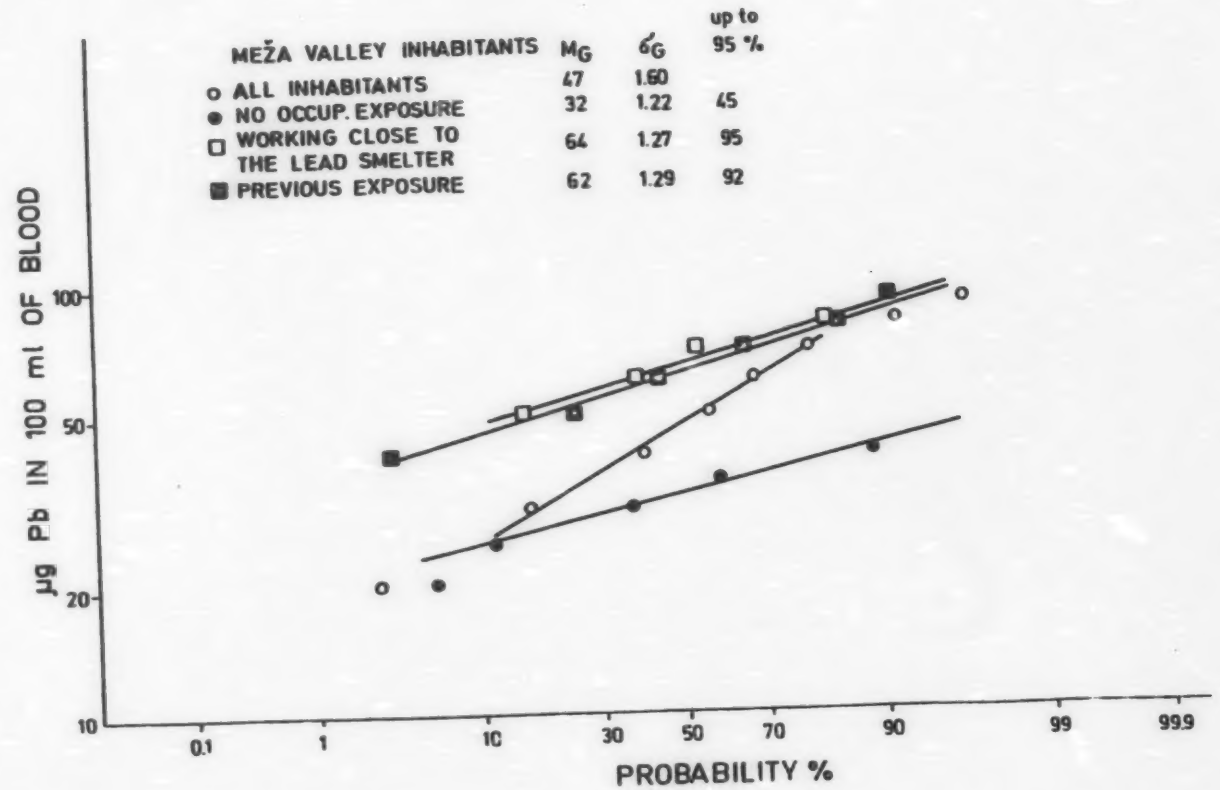

Figure B-17. Lead in blood - cumulative frequency distribution.

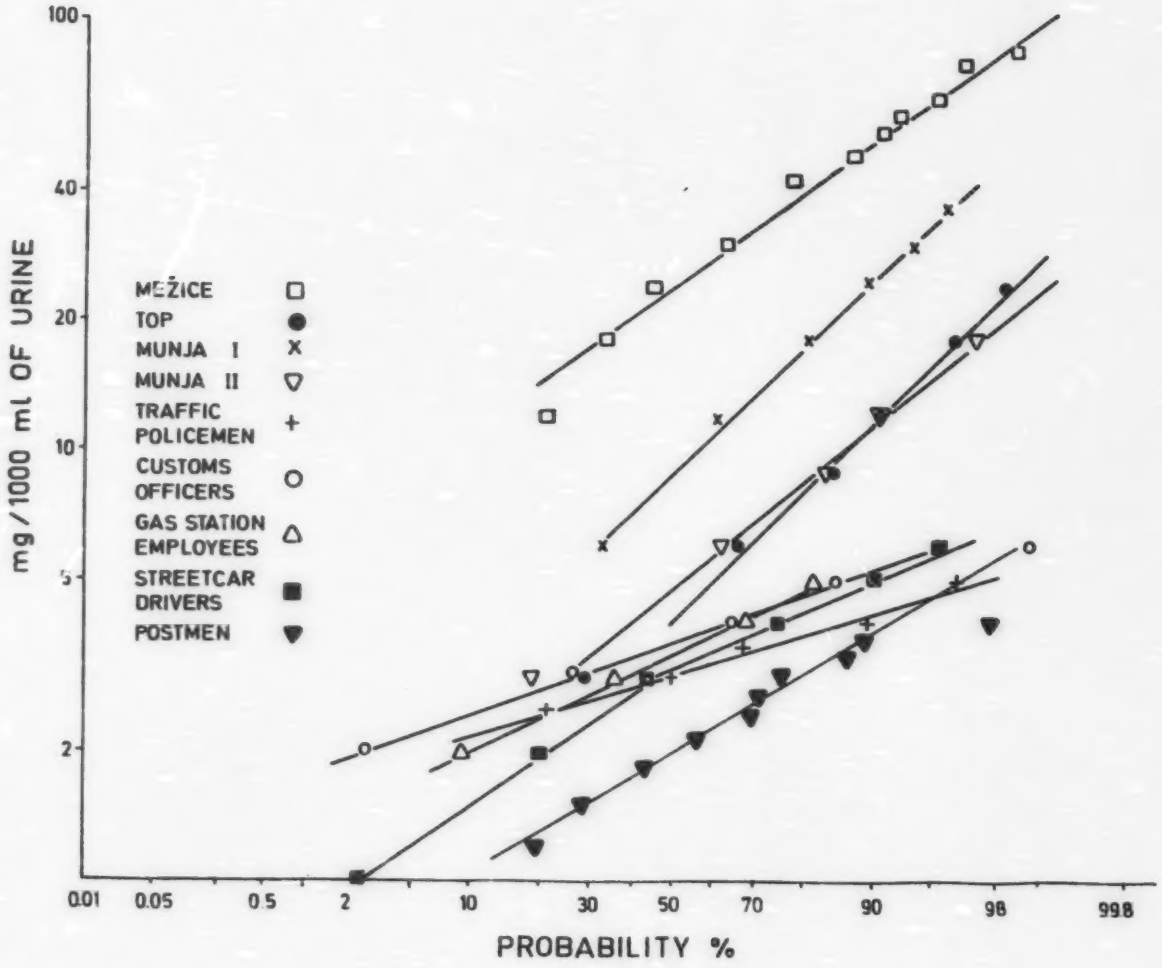

Figure B-18. ALA - cumulative frequency distribution.

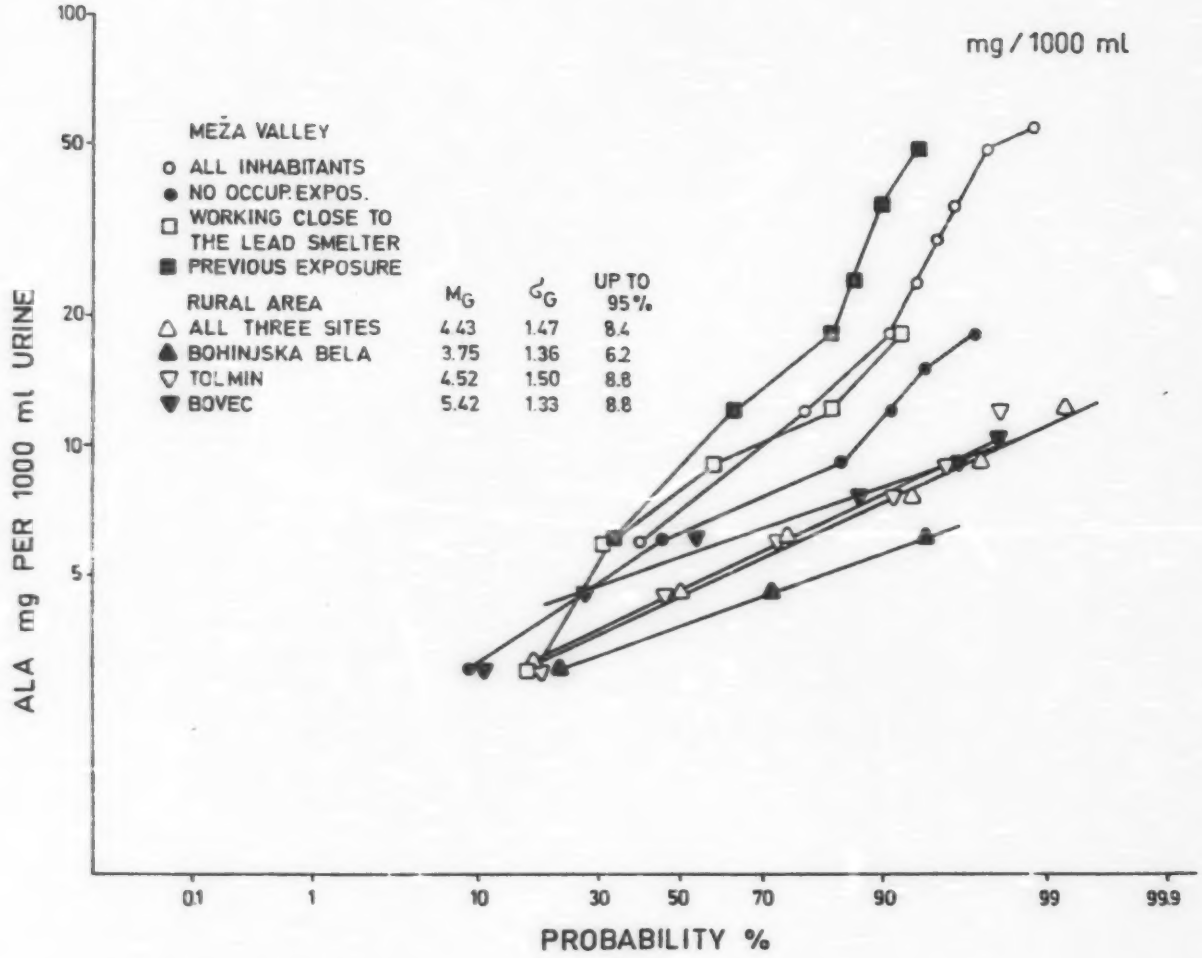

Figure B-19. ALA - cumulative frequency distribution.

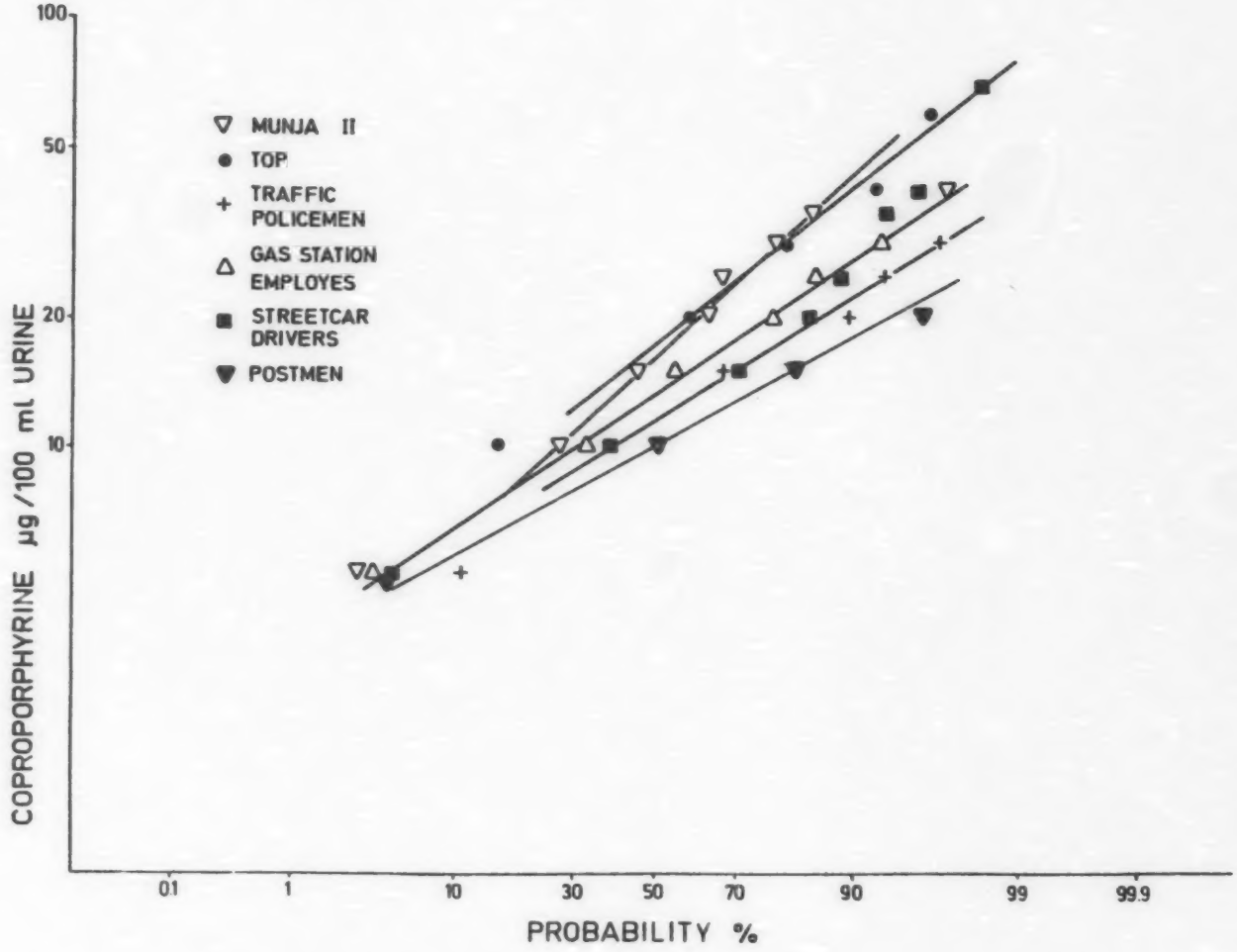

Figure B-20. Coproporphyrin - cumulative frequency distribution.

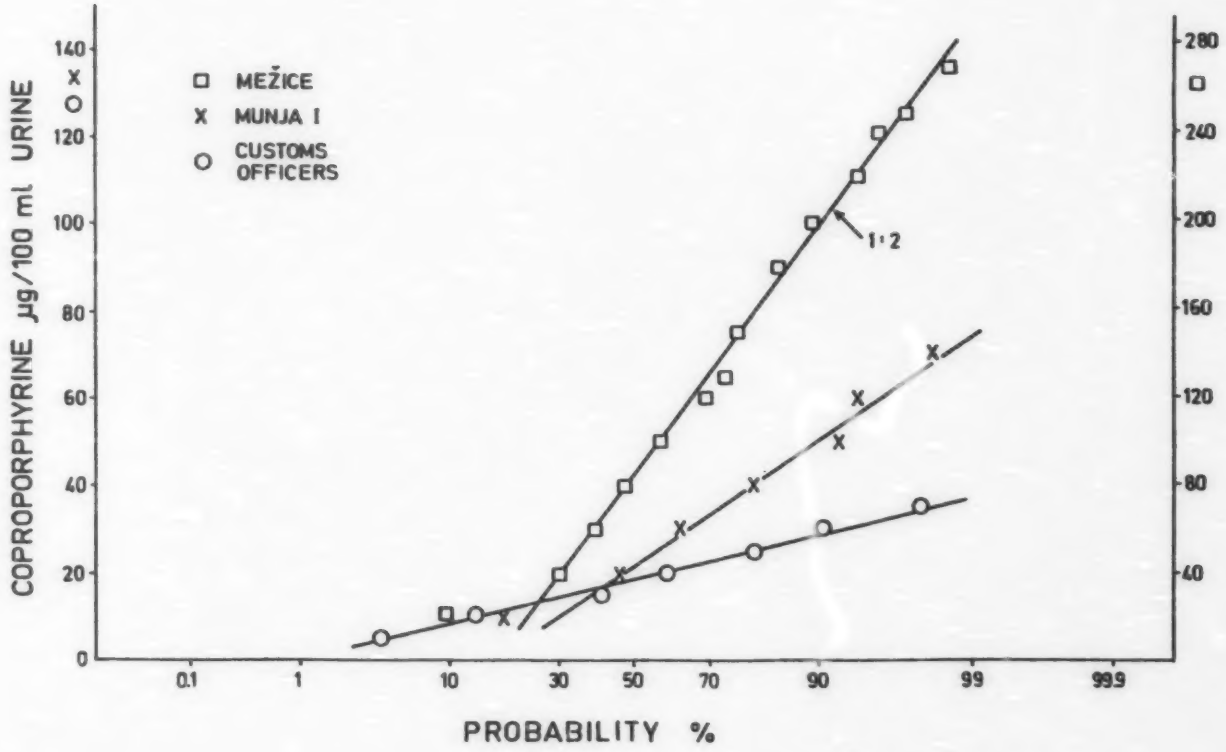

Figure B-21. Coproporphyrin - cumulative frequency distribution.

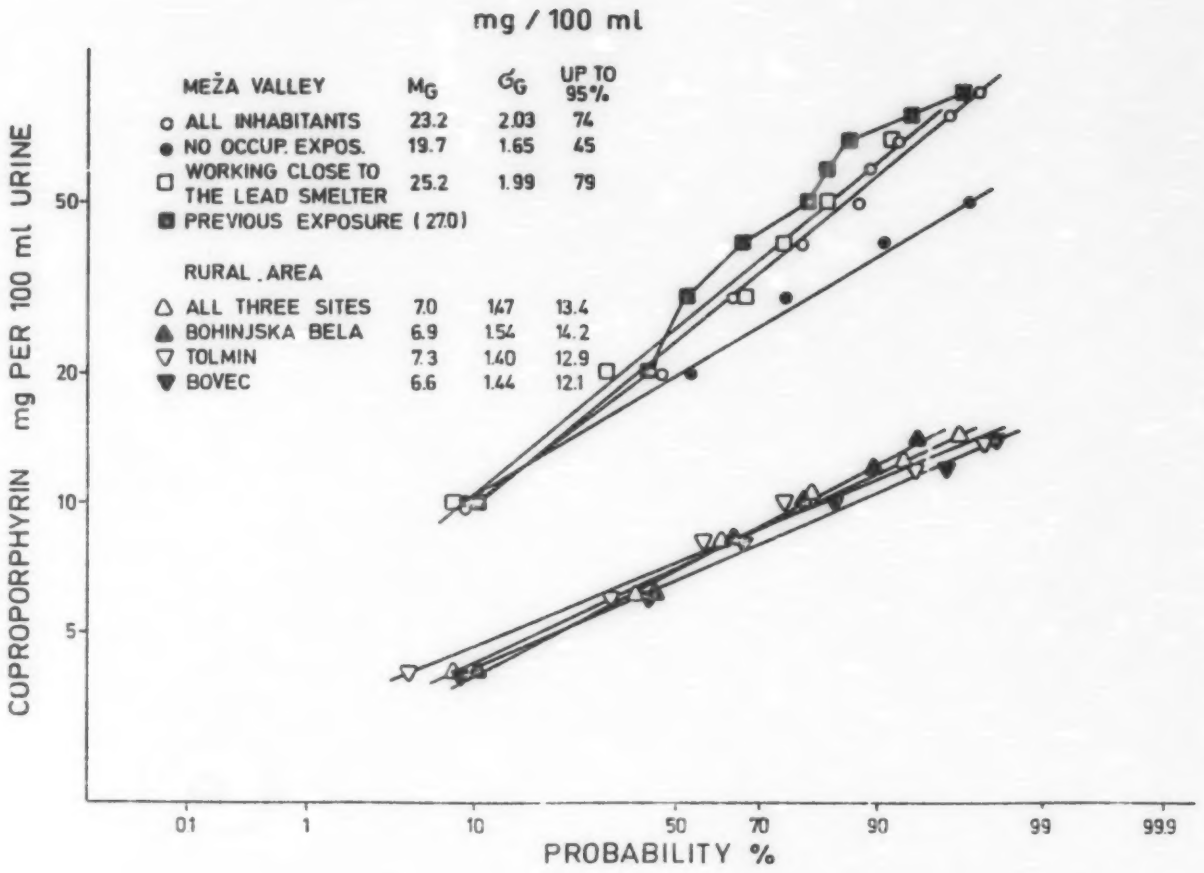

Figure B-22. Coproporphyrin - cumulative frequency distribution.

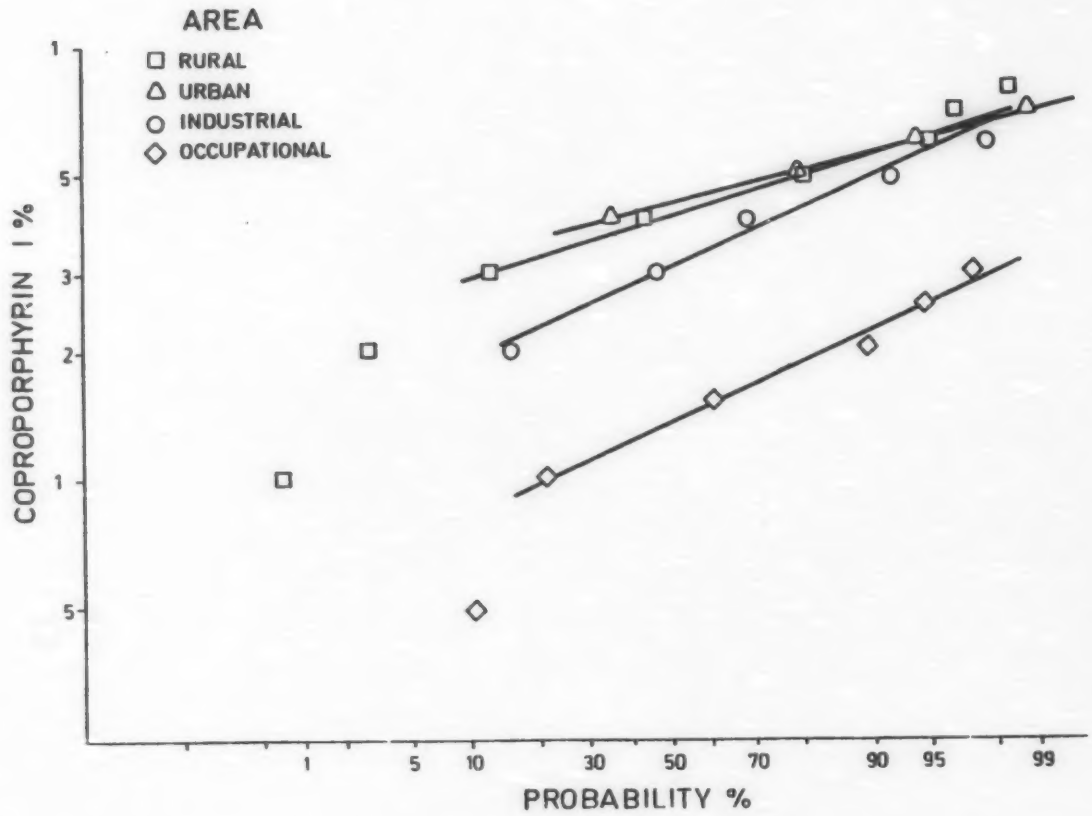

Figure B-23. Cumulative frequency distribution of Copro I isomer.

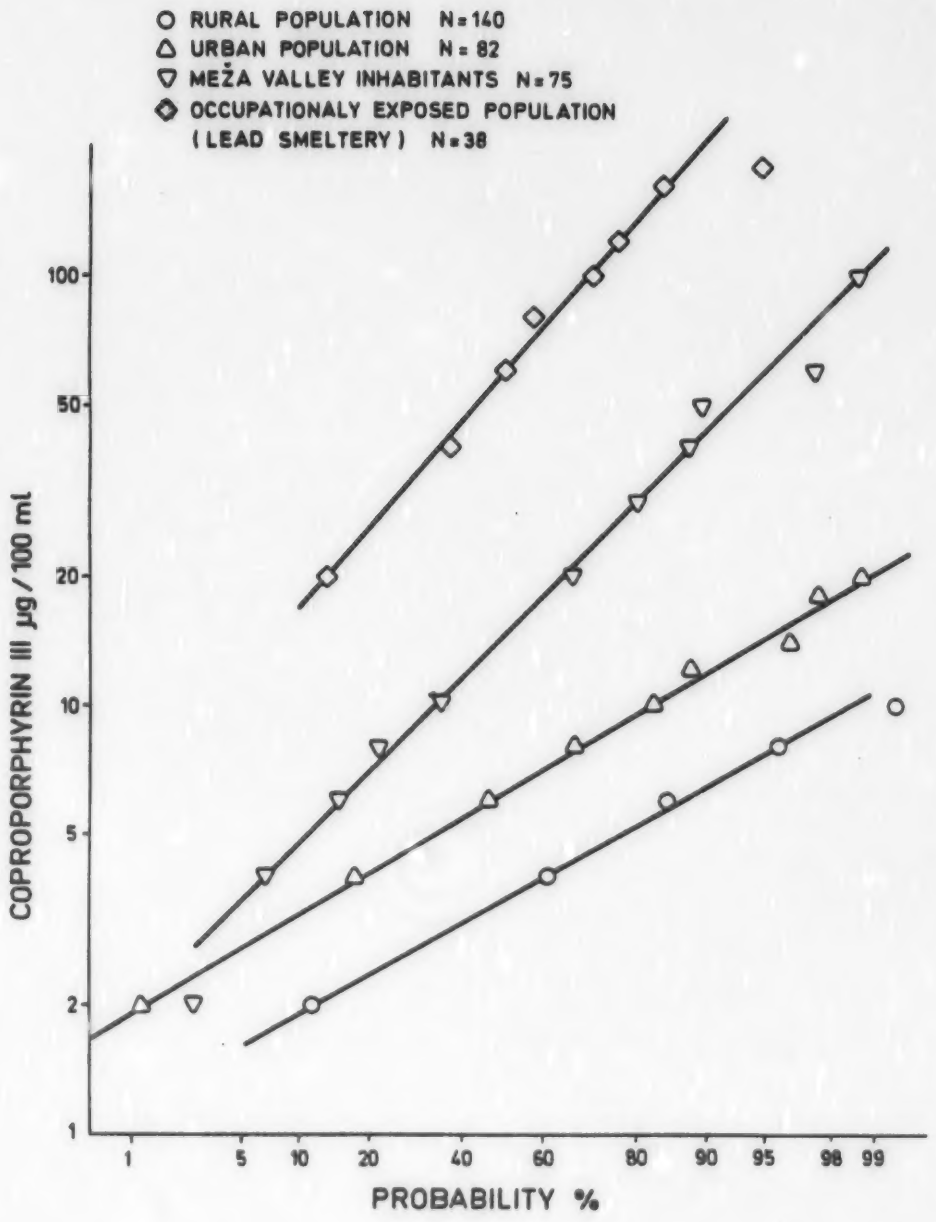

Figure B-24. Coproporphyrin III - cumulative frequency distribution.

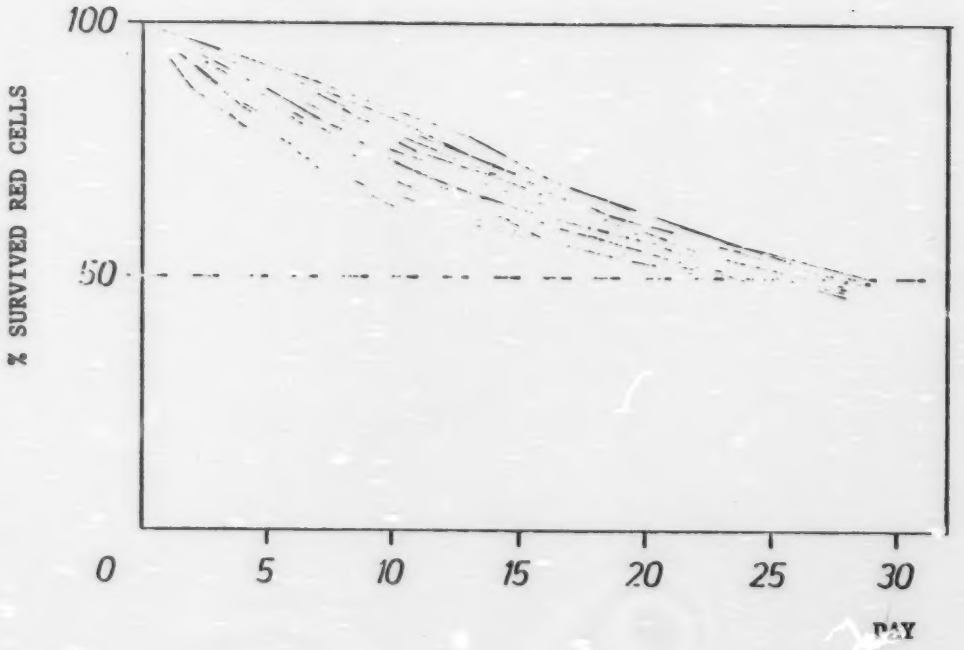

Figure B-25. Survival curves of Cr-51 labelled red cells in blood of normal subjects.

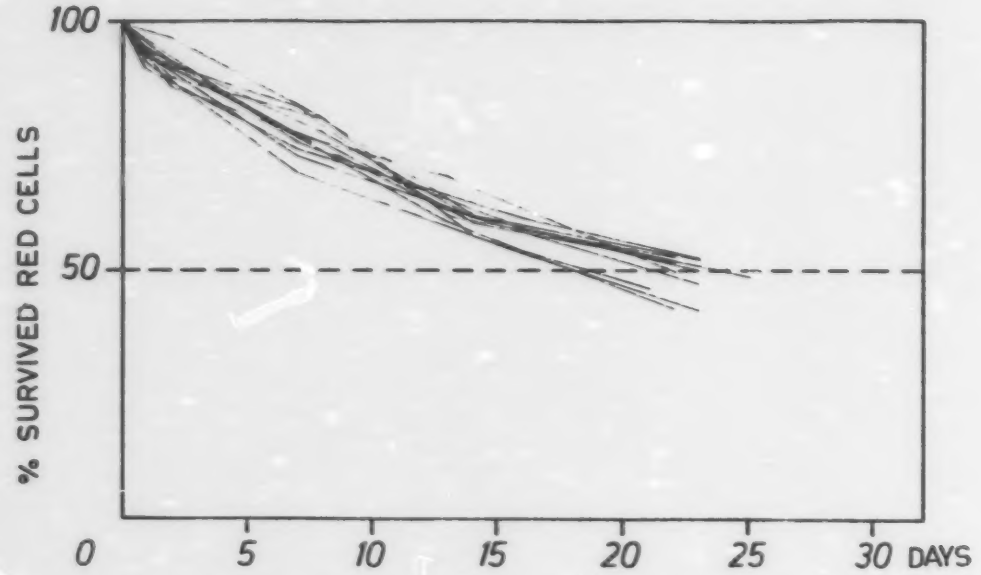

Figure B-26. Survival curves of Cr-51 labelled red cells in blood of traffic policemen.

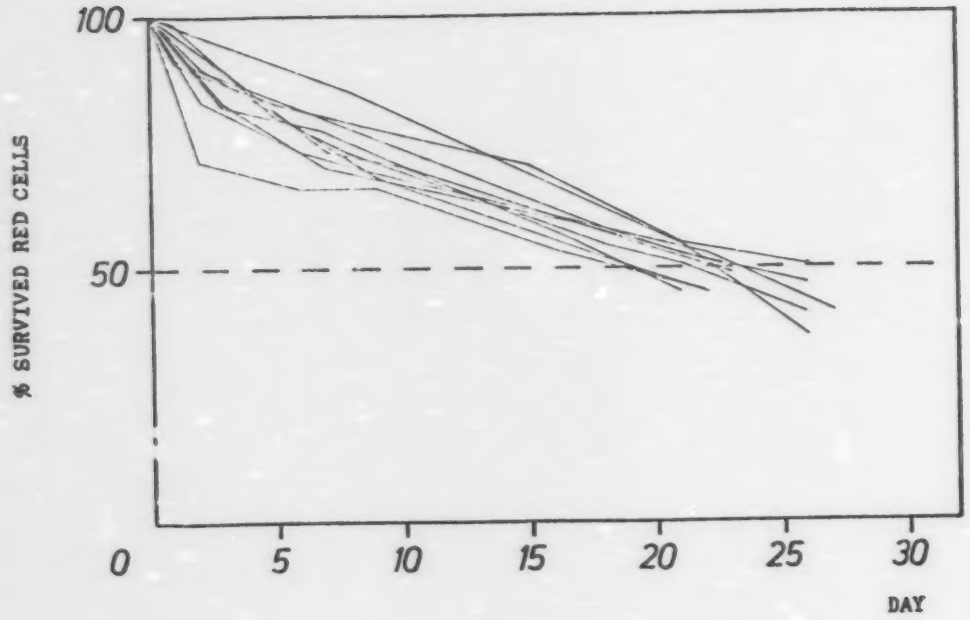

Figure B-27. Survival curves of Cr-51 labelled red cells in blood of lead exposed workers.

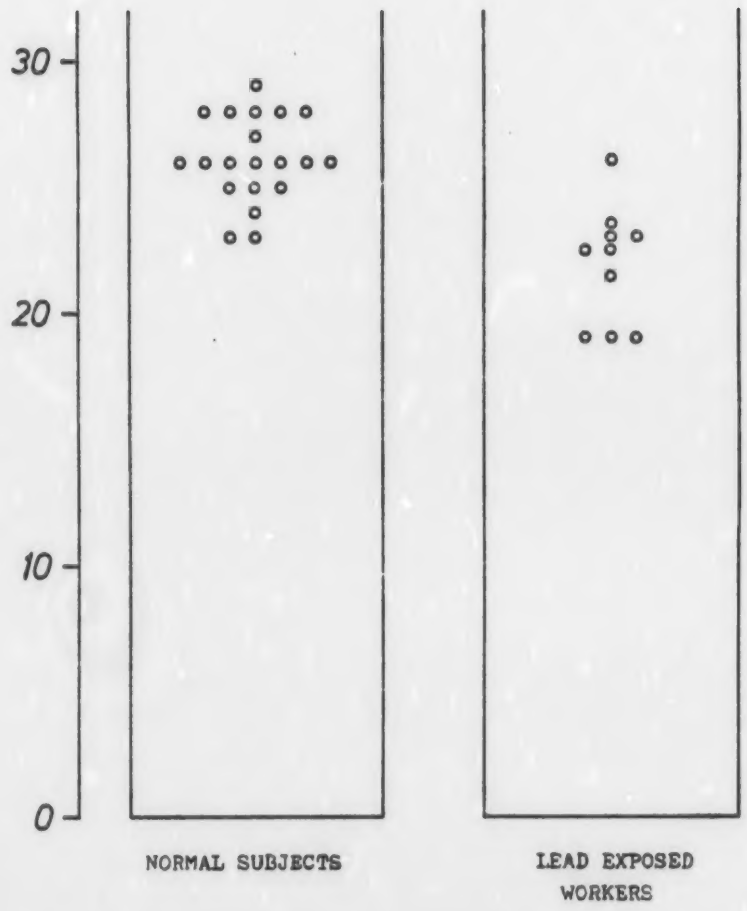

Figure B-28. Half life of labelled red cells (days).

TABLE B-1. RELATIONSHIP OF LEAD IN AIR TO BIOLOGICAL PARAMETERS - RURAL AREA

Location: Bohinjska Bela

Subject	Air: Lead µg/m³ M_G	Air: Lead µg/m³ $\bar{X}$	Blood: Hb g %	Blood: Htc cm³ %	Blood: BpE per 10^6E	Blood: Rtc %	Blood: G-6PD units per 100mlE	Blood: GSH mg per 100ml blood	Blood: ALAD units per 1mlE	Blood: Lead µg/100ml blood: original values	Blood: Lead µg/100ml blood: standard Hb adjusted values	Urine: ALA mg per 100ml	Urine: Coproporphyrin µg per 100ml
1	0.08	0.08	16.6	46.8	0	6	160.5	40.8	125.8	10.6	10.1	0.63	5
2	0.08	0.08	15.1	43.5	0	8	160.2	38.3	166.1	5.5	5.8	0.37	3
3	0.08	0.08	15.9	44.5	0	5	176.4	43.2	86.1	9.9	9.8	0.46	16
4	0.08	0.08	14.3	41.5	0	6	153.3	49.5	137.0	8.0	8.8	0.61	3
5	0.08	0.08	15.1	40.5	0	10	160.0	37.0	102.8	12.4	13.0	0.54	5
6	0.08	0.08	15.5	39.8	0	6	150.4	51.2	155.0	16.1	16.4	0.56	6
7	0.08	0.08	15.5	41.8	0	7	180.6	54.5	150.9	12.8	13.1	0.48	5
8	0.08	0.08	17.2	46.0	0	10	163.0	49.8	126.4	11.0	10.1	0.36	6
9	0.08	0.08	14.1	42.3	0	8	158.9	39.3	132.1	6.2	6.9	0.57	8
10	0.08	0.08	15.4	39.5	0	7	185.3	43.2	106.6	13.9	14.3	0.39	4

(continued)

TABLE B-1. (continued)

Location: Bohinjska Bela

Subject	Air: Lead µg/m³ M_G	Air: Lead µg/m³ $\bar{X}$	Blood: Hb g %	Blood: Htc cm³ %	Blood: BpE per 10^6E	Blood: Rtc %	Blood: G-6PD units per 100mlE	Blood: GSH mg per 100ml blood	Blood: ALAD units per 1mlE	Blood: Lead µg/100ml blood: original values	Blood: Lead µg/100ml blood: standard Hb adjusted values	Urine: ALA mg per 100ml	Urine: Coproporphyrin µg per 100ml
11	0.08	0.08	15.8	49.0	0	6	169.8	47.2	86.0	17.5	17.5	0.34	5
12	0.08	0.08	15.5	45.3	0	5	177.3	43.2	170.8	10.6	10.8	0.42	3
13	0.08	0.08	14.7	48.0	0	7	155.7	56.8	104.2	6.9	7.4	0.54	10
14	0.08	0.08	17.4	43.5	0	9	170.5	47.6	244.8	15.3	13.8	0.48	6
15	0.08	0.08	16.7	42.8	0	10	179.7	35.6	240.4	9.9	9.4	0.39	4
16	0.08	0.08	16.3	40.5	0	6	168.8	50.8	124.4	4.7	4.6	0.37	9
17	0.08	0.08	15.7	42.0	0	8	163.4	46.2	125.3	8.8	8.9	0.43	3
18	0.08	0.08	15.5	41.5	0	11	161.7	32.7	176.8	14.2	14.5	0.36	5
19	0.08	0.08	15.9	43.0	0	9	176.3	35.3	183.7	8.8	8.7	0.25	4
20	0.08	0.08	15.2	45.0	0	7	178.8	37.6	170.8	12.4	12.9	0.41	8
21	0.08	0.08	15.2	42.5	0	10	159.4	30.7	127.1	5.8	6.0	0.21	4
22	0.08	0.08	15.8	44.3	0	8	162.7	37.0	123.9	5.1	5.1	0.56	17
23	0.08	0.08	16.9	45.0	0	8	161.2	39.9	145.8	8.4	7.8	0.21	3
24	0.08	0.08	17.9	47.0	0	7	163.0	40.9	179.8	5.1	4.5	0.34	5
25	0.08	0.08	14.7	42.5	0	10	153.6	45.5	210.0	2.6	2.8	0.39	8

(continued)

TABLE B-1. (continued)

Location: Bohinjska Bela

Subject	Air		Blood									Urine	
	Lead µg/m³		Hb g %	Htc cm³ %	BpE per 10^6E	Rtc %	G-6PD units per 100mlE	GSH mg per 100ml blood	ALAD units per 1mlE	Lead µg/100ml blood		ALA mg per 100ml	Coproporphyrin µg per 100ml
	M_G	$\bar{X}$								original values	standard Hb adjusted values		
26	0.08	0.08	16.7	46.0	0	11	182.3	36.3	91.8	4.7	4.4	0.41	7
27	0.08	0.08	15.4	44.5	0	10	163.0	29.4	135.7	10.9	10.9	0.53	10
28	0.08	0.08	14.7	42.3	0	6	173.2	19.5	120.4	12.0	12.9	0.50	7
29	0.08	0.08	15.8	46.0	0	10	163.4	38.6	117.1	0.4	0.4	0.71	11
30	0.08	0.08	16.6	45.8	0	8	172.2	37.3	156.3	5.5	5.2	0.55	13
31	0.08	0.08	16.1	42.5	0	9	179.0	30.0	185.6	9.1	8.9	0.31	8
32	0.08	0.08	16.3	42.0	0	7	172.2	34.0	157.4	5.1	4.9	0.31	4
33	0.08	0.08	16.1	43.0	0	8	171.7	33.0	158.0	4.7	4.6	0.34	5
34	0.08	0.08	16.6	45.5	0	6	167.9	41.6	168.7	9.5	9.0	0.40	10
35	0.08	0.08	15.4	43.5	0	5	173.5	38.6	167.5	2.7	2.8	0.37	5
36	0.08	0.08	15.7	42.5	0	7	171.7	38.9	155.6	5.5	5.5	0.41	12
37	0.08	0.08	15.9	45.3	0	7	168.6	40.6	196.1	1.8	1.8	0.31	5
38	0.08	0.08	16.6	44.5	600	16	160.7	36.6	205.1	13.1	12.5	0.36	7
39	0.08	0.08	18.5	46.8	800	18	164.5	42.9	154.8	3.3	2.8	0.34	9
40	0.08	0.08	16.6	46.5	800	17	162.5	42.9	193.8	0.0	0.0	0.33	9
41	0.08	0.08	15.9	46.5	0	10	161.0	34.0	158.1	6.5	6.5	0.19	6

(continued)

TABLE B-1. (continued)

Location: Bohinjska Bela

Subject	Air		Blood									Urine	
	Lead µg/m³		Hb g %	Htc cm³ %	BpE per 10^6E	Rtc %	G-6PD units per 100mlE	GSH mg per 100ml blood	ALAD units per 1mlE	Lead µg/100ml blood		ALA mg per 100ml	Coproporphyrin µg per 100ml
	M_G	$\bar{X}$								original values	standard Hb adjusted values		
42	0.08	0.08	15.2	44.3	0	8	168.8	31.4	114.5	5.1	5.3	0.22	6
43	0.08	0.08	15.6	44.3	0	15	176.3	33.0	239.8	15.3	15.6	0.44	16
44	0.08	0.08	13.5	42.5	0	12	173.4	34.7	40.6	8.8	10.3	0.25	5
45	0.08	0.08	13.2	42.5	0	8	174.9	29.0	137.1	5.1	6.1	0.26	6
46	0.08	0.08	14.1	41.3	0	9	174.9	34.3	184.5	1.5	1.7	0.35	8
47	0.08	0.08	14.8	44.0	0	9	177.8	48.2	161.6	4.0	4.3	0.18	5
48	0.08	0.08	15.1	41.5	0	12	168.8	41.6	169.0	9.9	10.4	0.18	10
49	0.08	0.08	15.4	42.5	2100	19	176.4	37.4	192.6	0.4	0.4	0.20	6

TABLE B-2. RELATIONSHIP OF LEAD IN AIR TO BIOLOGICAL PARAMETERS - RURAL AREA

Location: Bovec

Subject	Air: Lead µg/m³ M_G	Air: Lead µg/m³ $\bar{X}$	Blood: Hb g %	Blood: Htc cm³ %	Blood: BpE per 10^6E	Blood: Rtc %	Blood: G-6PD units per 100mlE	Blood: GSH mg per 100ml blood	Blood: ALAD units per 1mlE	Blood: Lead µg/100ml blood: original values	Blood: Lead µg/100ml blood: standard Hb adjusted values	Urine: ALA mg per 100ml	Urine: Coproporphyrin µg per 100ml
50	0.10	0.09	19.4	47.3	0	7	151.8	47.5	47.1	4.0	3.3	0.68	7
51	0.10	0.09	16.3	46.5	0	8	164.9	44.6	150.3	6.9	6.7	0.46	5
52	0.10	0.09	14.9	44.5	0	10	191.6	38.3	197.8	1.5	1.6	0.72	5
53	0.10	0.09	11.7	44.5	0	9	193.2	36.3	197.6	9.1	12.3	0.76	8
54	0.10	0.09	16.3	41.8	0	9	161.0	47.2	206.0	11.7	11.3	0.59	6
55	0.10	0.09	17.5	44.3	0	13	159.5	47.2	233.9	12.4	11.2	0.44	5
56	0.10	0.09	16.3	43.5	0	10	211.0	46.2	159.2	4.0	3.9	0.64	11
57	0.10	0.09	15.8	45.5	0	8	212.5	36.0	138.2	12.4	12.4	0.42	5
58	0.10	0.09	18.0	46.5	0	10	161.0	40.9	105.9	20.8	18.3	0.69	5
59	0.10	0.09	16.7	44.0	0	15	202.5	34.0	117.3	11.7	11.1	1.09	12
60	0.10	0.09	16.0	43.5	0	13	207.2	43.6	167.2	15.7	15.5	0.78	8
61	0.10	0.09	14.9	43.8	0	8	214.6	41.6	153.4	11.3	12.0	0.45	7
62	0.10	0.09	18.6	43.5	0	11	210.7	34.7	190.8	8.0	6.8	0.45	8

TABLE B-2. (continued)

Location: Bovec

Subject	Air		Blood									Urine	
	Lead µg/m³		Hb g %	Htc cm³ %	BpE per 10^6E	Rtc %	G-6PD units per 100mlE	GSH mg per 100ml blood	ALAD units per 1mlE	Lead µg/100ml blood		ALA mg per 100ml	Coproporphyrin µg per 100ml
	M_G	$\bar{X}$								original values	standard Hb adjusted values		
63	0.10	0.09	17.4	43.0	0	10	215.3	45.5	166.9	7.3	6.6	0.73	6
64	0.10	0.09	15.3	38.5	0	9	212.0	48.5	230.8	20.8	21.5	0.57	10
65	0.10	0.09	16.2	40.8	0	14	186.9	39.3	151.2	9.9	9.7	0.62	7
66	0.10	0.09	16.1	43.8	0	9	183.5	41.9	98.9	20.1	19.7	0.42	9
67	0.10	0.09	15.8	45.5	0	11	179.1	39.6	164.6	8.8	8.8	0.28	3
68	0.10	0.09	17.4	45.8	0	6	168.3	37.8	155.8	13.9	12.6	0.82	5
69	0.10	0.09	15.3	44.5	0	8	175.6	34.7	155.6	15.0	15.5	0.57	6
70	0.10	0.09	15.3	45.0	0	9	149.5	30.0	92.5	11.3	11.7	0.65	9
71	0.10	0.09	15.6	45.3	0	10	162.0	34.3	172.2	16.4	16.6	0.67	6
72	0.10	0.09	16.3	46.8	0	9	177.5	35.0	202.5	16.4	15.9	0.51	2
73	0.10	0.09	16.6	45.0	0	11	157.0	37.6	198.1	11.3	10.8	0.20	4
74	0.10	0.09	16.6	42.0	0	7	158.6	32.7	192.6	11.3	10.8	0.47	5
75	0.10	0.09	15.5	44.1	0	6	179.0	44.9	138.1	14.6	14.9	0.43	4
76	0.10	0.09	16.1	45.0	0	8	185.4	43.2	141.4	5.1	5.0	0.70	4
77	0.10	0.09	15.6	42.5	0	10	168.4	38.0	130.4	8.8	8.9	0.67	9

(continued)

TABLE B-2. (continued)

Location: Bovec

Subject	Air: Lead µg/m³ M_G	Air: Lead µg/m³ $\bar{X}$	Blood: Hb g %	Blood: Htc cm³ %	Blood: BpE per 10^6E	Blood: Rtc %	Blood: G-6PD units per 100mlE	Blood: GSH mg per 100ml blood	Blood: ALAD units per 1mlE	Blood: Lead µg/100ml blood: original values	Blood: Lead µg/100ml blood: standard Hb adjusted values	Urine: ALA mg per 100ml	Urine: Coproporphyrin µg per 100ml
78	0.10	0.09	15.8	44.5	0	6	171.4	38.2	109.8	5.1	5.1	0.41	4
79	0.10	0.09	15.7	42.3	0	13	170.2	32.3	128.5	9.9	10.0	0.52	7
80	0.10	0.09	17.7	48.5	0	10	149.5	39.6	170.6	12.4	11.1	0.54	5
81	0.10	0.09	15.5	40.3	0	9	159.4	33.0	148.9	12.8	13.0	0.50	3
82	0.10	0.09	16.6	44.5	0	6	178.5	40.3	194.4	9.1	8.7	0.47	4
83	0.10	0.09	16.4	44.3	0	9	169.1	45.9	192.7	7.3	7.0	0.43	10
84	0.10	0.09	16.1	46.8	0	5	191.6	39.9	93.5	20.8	20.4	0.71	8
85	0.10	0.09	17.3	44.5	0	8	194.7	47.2	106.7	17.5	16.0	0.19	4
86	0.10	0.09	15.3	42.5	0	10	178.4	42.9	153.5	8.0	8.3	0.64	3
87	0.10	0.09	15.5	44.3	0	6	154.4	45.2	193.6	8.8	9.0	0.65	11
88	0.10	0.09	13.1	43.0	0	8	202.2	41.9	197.4	8.8	10.6	0.78	7
89	0.10	0.09	14.7	42.0	0	12	159.0	51.8	89.0	8.4	9.0	0.84	5
90	0.10	0.09	17.0	46.5	0	10	191.5	57.1	151.6	11.3	10.5	0.66	4
91	0.10	0.09	16.4	42.0	0	6	197.9	45.9	135.3	12.8	12.3	0.92	9
92	0.10	0.09	15.3	44.5	0	8	182.3	40.6	180.1	0.4	0.4	0.25	6

(continued)

TABLE B-2. (continued)

Location: Bovec

Subject	Air		Blood									Urine	
	Lead µg/m³		Hb g %	Htc cm³ %	BpE per 10^6E	Rtc %	G-6PD units per 100mlE	GSH mg per 100ml blood	ALAD units per 1mlE	Lead µg/100ml blood		ALA mg per 100ml	Copropor-phyrin µg per 100ml
	M_G	$\bar{X}$								original values	standard Hb adjusted values		
93	0.10	0.09	16.5	45.0	0	10	167.7	49.8	155.6	16.1	15.4	0.28	6
94	0.10	0.09	14.7	47.8	0	7	190.1	44.2	172.4	13.9	14.9	0.44	11
95	0.10	0.09	14.5	43.0	0	13	172.7	43.9	175.3	13.9	15.1	0.42	16
96	0.10	0.09	15.8	41.0	0	14	170.7	38.3	159.1	16.1	16.1	0.57	9

TABLE B-3. RELATIONSHIP OF LEAD IN AIR TO BIOLOGICAL PARAMETERS - RURAL AREA

Location: Tolmin

Subject	Air: Lead µg/m³ M_G	Air: Lead µg/m³ $\bar{X}$	Blood: Hb g %	Blood: Htc cm³ %	Blood: BpE per 10^6E	Blood: Rtc %	Blood: G-6PD units per 100mlE	Blood: GSH mg per 100ml blood	Blood: ALAD units per 1mlE	Blood: Lead µg/100ml blood: original values	Blood: Lead µg/100ml blood: standard Hb adjusted values	Urine: ALA mg per 100ml	Urine: Coproporphyrin µg per 100ml
97	0.14	0.15	15.6	44.0	0	12	191.6	21.5	186.4	7.7	7.8	0.46	6
98	0.14	0.15	15.4	44.0	0	11	162.6	33.3	215.9	7.7	7.9	0.73	9
99	0.14	0.15	15.1	45.0	0	10	185.2	29.7	215.5	4.7	4.9	0.37	4
100	0.14	0.15	15.0	41.0	0	12	204.5	34.0	174.3	12.4	13.1	0.37	7
101	0.14	0.15	17.1	43.0	0	9	214.7	21.8	114.8	12.4	11.5	0.46	10
102	0.14	0.15	14.5	44.0	0	10	185.0	21.8	166.7	11.7	12.8	0.54	11
103	0.14	0.15	16.5	49.0	0	8	217.4	40.6	184.1	6.9	6.6	0.71	7
104	0.14	0.15	16.5	50.0	0	11	212.5	39.3	165.0	14.6	14.0	0.65	8
105	0.14	0.15	16.5	46.0	1200	20	182.6	35.6	169.2	8.8	8.4	0.38	4
106	0.14	0.15	17.8	47.0	0	8	200.9	29.7	159.3	15.0	13.3	0.43	6
107	0.14	0.15	16.1	43.0	0	11	159.5	26.7	195.0	12.8	12.6	0.54	10
108	0.14	0.15	15.1	44.0	0	8	211.8	21.8	128.9	6.6	6.9	0.64	10
109	0.14	0.15	15.3	45.0	1100	22	161.3	23.1	75.0	15.3	15.8	0.50	5
110	0.14	0.15	16.4	46.0	0	10	181.0	37.0	99.2	12.8	12.3	0.31	2

(continued)

TABLE B-3. (continued)

Location: Tolmin

Subject	Air: Lead µg/m³ M_G	Air: Lead µg/m³ $\bar{X}$	Blood: Hb g %	Blood: Htc cm³ %	Blood: BpE per 10^6E	Blood: Rtc %	Blood: G-6PD units per 100mlE	Blood: GSH mg per 100ml blood	Blood: ALAD units per 1mlE	Blood: Lead µg/100ml blood: original values	Blood: Lead µg/100ml blood: standard Hb adjusted values	Urine: ALA mg per 100ml	Urine: Coproporphyrin µg per 100ml
111	0.14	0.15	15.9	43.0	1000	18	212.8	38.0	110.5	13.1	13.0	0.62	5
112	0.14	0.15	15.7	48.0	0	13	219.3	41.6	133.1	10.6	10.7	0.53	5
113	0.14	0.15	16.0	44.0	0	6	210.5	29.0	144.0	15.7	15.5	0.70	8
114	0.14	0.15	18.1	47.3	0	7	168.3	34.3	179.5	6.6	5.8	0.80	9
115	0.14	0.15	15.7	43.8	0	9	194.8	47.5	141.8	2.2	2.2	0.39	4
116	0.14	0.15	15.0	49.3	0	7	177.4	34.6	156.1	6.9	7.3	0.34	11
117	0.14	0.15	14.2	44.0	0	6	175.2	39.6	156.5	2.6	2.9	0.84	5
118	0.14	0.15	16.3	42.8	0	9	196.4	36.6	141.3	7.3	7.1	0.28	3
119	0.14	0.15	15.5	42.3	0	11	193.2	32.7	181.8	13.5	13.8	0.54	7
120	0.14	0.15	17.8	44.0	0	12	162.6	34.7	166.5	9.5	8.4	0.63	8
121	0.14	0.15	16.7	43.3	0	7	168.3	30.4	172.4	7.3	6.9	0.54	8
122	0.14	0.15	16.4	42.3	0	6	218.2	32.7	199.1	11.3	10.9	0.59	6
123	0.14	0.15	15.4	40.5	0	10	209.1	33.3	159.6	8.8	9.0	0.35	7
124	0.14	0.15	15.7	43.0	0	9	171.4	35.3	215.4	4.7	4.7	1.35	12

(continued)

TABLE B-3. (continued)

Location: Tolmin

Subject	Air		Blood									Urine	
	Lead µg/m³		Hb g %	Htc cm³ %	BpE per 10^6E	Rtc %	G-6PD units per 100mlE	GSH mg per 100ml blood	ALAD units per 1mlE	Lead µg/100ml blood		ALA mg per 100ml	Copropor-phyrin µg per 100ml
	M_G	$\bar{X}$								original values	standard Hb adjusted values		
125	0.14	0.15	15.7	42.5	0	10	164.7	37.3	177.9	8.0	8.1	1.09	6
126	0.14	0.15	15.5	41.5	0	6	193.2	29.7	158.3	13.9	14.2	0.40	4
127	0.14	0.15	14.5	42.5	0	12	172.3	35.6	167.9	12.0	13.1	0.28	4
128	0.14	0.15	14.7	43.0	0	6	165.8	27.4	131.1	8.0	8.6	0.26	12
129	0.14	0.15	15.4	43.0	0	8	193.2	24.1	170.9	8.0	8.2	0.17	8
130	0.14	0.15	16.4	46.5	0	11	162.4	23.1	184.9	12.4	11.9	0.34	9
131	0.14	0.15	15.1	45.5	0	12	152.7	43.6	109.3	16.1	16.9	0.28	5
132	0.14	0.15	13.8	46.0	0	10	193.2	29.4	235.3	8.0	9.2	0.15	6
133	0.14	0.15	16.4	41.5	0	7	171.8	39.3	109.9	19.7	19.0	0.21	11
134	0.14	0.15	16.0	43.5	500	15	203.0	45.2	202.9	16.8	16.6	0.55	5
135	0.14	0.15	15.3	42.0	0	9	165.2	28.0	166.7	13.1	13.5	0.22	17
136	0.14	0.15	14.5	41.0	600	16	193.2	27.3	245.5	13.5	14.7	0.32	5
137	0.14	0.15	14.5	42.3	0	11	158.5	26.7	142.6	11.7	12.8	0.67	10
138	0.14	0.15	14.9	42.0	0	7	168.7	23.1	200.0	11.7	12.4	0.37	5
139	0.14	0.15	17.4	43.5	0	10	191.6	19.4	123.3	9.1	8.3	0.33	4
140	0.14	0.15	14.1	45.3	0	8	177.1	29.0	165.6	5.8	6.5	0.50	7
141	0.14	0.15	15.4	44.0	0	10	189.9	35.9	225.3	15.7	16.1	0.57	11

TABLE B-4. RELATIONSHIP OF LEAD IN AIR TO BIOLOGICAL PARAMETERS - URBAN AREA

Postmen and other post office workers

	Air	Blood									Urine	
									Lead µg/100ml blood			
Subject	Lead* µg/m³	Hb g %	Htc cm³ %	BpE per 10^6E	Rtc %	G-6PD units per 100mlE	GSH mg per 100ml blood	ALAD units per 1mlE	original values	standard Hb adjusted values	ALA mg per 100ml	Coproporphyrin µg per 100ml
142	1.6	15.9	44.0	0	9	200.7	40.6	136.4	36.4	36.2	0.38	16
143	1.6	15.4	43.0	1000	14	227.0	36.6	147.4	19.6	20.1	0.37	13
144	1.6	16.6	44.5	1100	15	246.0	33.7	91.3	31.9	30.4	0.26	13
145	1.6	16.2	44.5	0	12	229.0	30.7	118.8	7.3	7.1	0.34	7
146	1.6	16.0	45.0	0	7	258.2	36.0	161.1	12.3	12.1	0.40	10
147	1.6	16.1	43.8	0	8	231.0	31.0	70.5	12.7	12.5	0.31	11
148	1.6	15.4	45.0	1000	19	231.0	32.3	111.7	16.4	16.8	0.09	12
149	1.6	15.5	44.0	400	28	276.0	30.0	139.2	18.2	18.6	0.32	6
150	1.6	16.5	43.5	0	12	226.0	41.6	170.1	12.3	11.8	0.39	14
151	1.6	16.1	46.0	0	8	242.8	39.6	163.6	19.1	18.7	0.33	11
152	1.6	15.2	42.5	1000	12	203.8	27.4	147.9	30.9	32.1	0.23	12
153	1.6	16.7	46.5	1000	19	223.0	46.2	90.3	29.1	27.5	0.20	8
154	1.6	16.0	45.0	0	8	265.0	21.5	137.8	8.2	8.1	0.18	8
155	1.6	14.4	42.0	0	9	224.0	26.4	170.5	7.3	8.0	0.17	12
156	1.6	16.0	45.5	0	13	232.0	25.1	144.2	21.4	21.1	0.22	8
157	1.6	15.9	44.0	600	15	227.4	36.3	88.9	4.1	4.1	0.19	24
158	1.6	16.4	45.0	0	10	219.2	29.7	138.6	10.9	10.5	0.16	11

* Estimated weighted average exposure

(continued)

TABLE B-4. (continued)

Postmen and other post office workers

Sub-ject	Air	Blood									Urine	
	Lead* µg/m³	Hb g %	Htc cm³ %	BpE per 10^6E	Rtc %	G-6PD units per 100mlE	GSH mg per 100ml blood	ALAD units per 1mlE	Lead µg/100ml blood: original values	Lead µg/100ml blood: standard Hb adjusted values	ALA mg per 100ml	Copropor-phyrin µg per 100ml
159	1.6	16.5	45.0	1400	19	207.0	24.4	117.5	16.8	16.1	0.14	10
160	1.6	15.2	42.5	0	8	226.0	28.1	118.2	10.9	11.3	0.19	6
161	1.6	16.7	47.0	0	13	232.0	32.3	144.4	25.0	23.7	0.08	16
162	1.6	16.0	44.0	0	7	200.0	25.1	114.5	22.8	22.5	0.12	10
163	1.6	17.4	46.0	1200	14	203.9	22.1	107.1	21.8	19.8	0.21	9
164	1.6	15.2	45.0	0	13	173.0	27.7	84.7	30.9	32.1	0.13	10
165	1.6	14.2	43.5	1100	14	196.1	47.9	55.2	2.7	3.0	0.15	7
166	1.6	17.5	47.5	0	9	193.5	34.0	104.5	31.9	28.7	0.30	63
167	1.6	16.9	44.5	0	7	182.2	26.4	117.1	25.5	23.8	0.12	8
168	1.6	16.7	47.0	0	10	204.2	43.9	193.9	9.0	8.5	0.06	11
169	1.6	16.4	46.0	0	7	247.0	35.6	173.4	34.6	33.2	0.04	15
170	1.6	15.7	44.0	400	13	195.0	35.0	91.8	6.4	6.4	0.28	20
171	1.6	15.4	44.0	0	10	229.2	35.6	112.2	9.1	9.3	0.24	9
172	1.6	17.1	45.5	400	16	195.5	35.6	92.0	20.9	19.3	0.10	3
173	1.6	15.2	43.5	600	10	219.8	43.2	49.4	25.0	26.0	0.33	7
174	1.6	15.2	41.0	500	11	183.1	36.3	100.6	25.5	26.5	0.10	4
175	1.6	16.6	44.0	0	13	206.0	41.9	152.0	7.7	7.3	0.13	15

* Estimated weighted average exposure

(continued)

TABLE B-4. (continued)

Postmen and other post office workers

Sub-ject	Air	Blood									Urine	
	Lead* µg/m³	Hb g %	Htc cm³ %	BpE per 10^6E	Rtc %	G-6PD units per 100mlE	GSH mg per 100ml blood	ALAD units per 1mlE	Lead µg/100ml blood: original values	Lead µg/100ml blood: standard Hb adjusted values	ALA mg per 100ml	Copropor-phyrin µg per 100ml
176	1.6	15.9	45.0	0	9	218.0	29.4	151.4	28.7	28.5	0.17	10
177	1.6	15.9	44.0	0	5	191.8	36.0	134.4	26.4	26.2	0.22	11
178	1.6	15.4	44.0	(	7	202.4	32.3	141.8	27.3	28.0	0.24	8
179	1.6	17.1	46.5	300	19	170.5	40.3	162.8	11.4	10.5	0.39	10
180	1.6	17.4	46.5	0	7	169.8	36.3	135.0	14.1	12.8	0.19	7
181	1.6	15.6	44.0	400	10	180.0	30.4	168.4	20.5	20.7	0.23	16
182	1.6	17.4	48.0	0	13	171.0	44.0	112.2	24.1	21.9	0.21	13
183	1.6	15.2	44.0	3000	15	170.1	37.0	112.8	4.6	4.8	0.17	9
184	1.6	17.1	47.0	0	15	199.2	42.2	77.4	9.1	8.4	0.17	25
185	1.6	16.7	47.0	700	17	184.0	45.5	79.0	13.3	12.0	0.33	19

Estimated weighted average exposure

(continued)

TABLE B-5. RELATIONSHIP OF LEAD IN AIR TO BIOLOGICAL PARAMETERS - URBAN AREA

Gas station employees

	Air			Blood									Urine	
	Lead µg/m³										Lead µg/100ml blood			
Subject	M_G	$\bar{X}$	weighted average exposure	Hb g %	Htc cm³ %	BpE per 10^6E	Rtc %	G-6PD units per 100mlE	GSH mg per 100ml blood	ALAD units per 1mlE	original values	standard Hb adjusted values	ALA mg per 100ml	Coproporphyrin µg per 100ml
186	4.0	4.3	1.9	14.4	42.0	0	9	189.5	39.3	60.9	7.6	8.3	0.22	10
187	4.0	4.3	1.9	15.3	44.0	900	18	181.9	54.1	30.4	11.6	12.0	0.36	16
188	4.0	4.3	1.9	16.2	46.0	1800	18	168.5	37.3	22.0	18.2	17.8	0.26	6
189	4.0	4.3	1.9	17.3	47.0	0	10	150.9	34.7	105.5	10.9	10.0	0.56	26
190	4.0	4.3	1.9	16.4	46.0	600	16	185.8	33.0	152.7	17.6	17.0	0.49	14
191	4.0	4.3	1.9	15.8	43.5	500	15	194.6	36.3	109.2	14.9	14.9	0.40	12
192	4.0	4.3	1.9	13.7	39.0	500	14	177.6	37.6	178.0	7.3	8.4	0.46	14
193	4.0	4.3	1.9	16.4	46.0	0	10	184.3	39.6	72.0	13.6	13.1	0.23	8
194	4.0	4.3	1.9	17.7	48.0	0	11	190.9	33.0	80.2	12.9	11.5	0.23	14
195	4.0	4.3	1.9	16.1	45.0	0	12	188.7	34.3	53.3	0.0	0.0	0.23	11
196	4.0	4.3	1.9	16.4	46.0	0	13	191.2	36.7	72.8	11.3	10.9	0.26	19
197	4.0	4.3	1.9	16.2	46.0	0	10	183.4	34.7	16.3	26.2	25.5	0.57	66
198	4.0	4.3	1.9	16.4	46.0	0	13	170.5	33.0	64.9	22.5	21.7	0.20	18
199	4.0	4.3	1.9	15.6	44.0	0	14	208.2	41.3	132.1	15.9	16.1	0.33	20
200	4.0	4.3	1.9	17.2	47.5	0	10	195.1	37.9	57.8	14.6	13.4	0.20	8
201	4.0	4.3	1.9	15.2	44.0	0	15	191.6	39.6	26.7	17.9	18.6	0.46	24

(continued)

TABLE B-5. (continued)

Gas station employees

Subject	Air			Blood									Urine	
	Lead µg/m³										Lead µg/100ml blood			
	M_G	$\bar{X}$	weighted average exposure	Hb g %	Htc cm^3 %	BpE per 10^6E	Rtc %	G-6PD units per 100mlE	GSH mg per 100ml blood	ALAD units per 1mlE	original values	standard Hb adjusted values	ALA mg per 100ml	Copropor-phyrin µg per 100ml
202	4.0	4.3	1.9	14.1	41.0	0	12	161.7	38.9	75.6	7.3	8.2	0.40	24
203	4.0	4.3	1.9	14.5	43.0	0	13	192.1	36.3	116.8	0.0	0.0	0.36	109
204	4.0	4.3	1.9	15.7	45.0	0	12	204.5	37.6	45.2	11.6	11.7	0.40	10
205	4.0	4.3	1.9	16.7	46.5	0	12	172.5	36.3	34.3	15.9	15.0	0.56	19
206	4.0	4.3	1.9	15.9	44.5	0	14	206.3	33.0	39.0	7.6	7.6	0.52	8
207	4.0	4.3	1.9	15.6	45.0	0	13	196.1	34.3	36.6	11.3	11.4	0.40	10

TABLE B-6. RELATIONSHIP OF LEAD IN AIR TO BIOLOGICAL PARAMETERS - URBAN AREA

Streetcar drivers

	Air			Blood									Urine	
	Lead µg/m³										Lead µg/100ml blood			
Subject	M_G	$\bar{X}$	weighted average exposure	Hb g %	Htc cm³ %	BpE per 10^6E	Rtc %	G-6PD units per 100mlE	GSH mg per 100ml blood	ALAD units per 1mlE	original values	standard Hb adjusted values	ALA mg per 100ml	Coproporphyrin µg per 100ml
208	3.9	5.1	2.1	14.5	42.5	0	10	189.7	34.9	33.8	7.8	8.5	0.25	12
209	3.9	5.1	2.1	16.2	47.0	0	10	184.6	34.9	48.3	18.7	18.2	0.31	23
210	3.9	5.1	2.1	15.9	46.0	0	7	237.4	35.9	46.4	23.4	23.3	0.21	8
211	3.9	5.1	2.1	14.9	43.5	0	8	239.4	40.3	47.7	20.3	21.5	0.27	31
212	3.9	5.1	2.1	15.5	45.0	0	6	190.3	45.8	58.3	39.0	39.8	0.18	12
213	3.9	5.1	2.1	15.2	43.5	0	11	211.4	41.6	53.1	20.3	21.1	0.34	10
214	3.9	5.1	2.1	15.1	44.0	0	12	196.8	30.7	78.1	43.7	45.7	0.25	12
215	3.9	5.1	2.1	15.2	43.5	0	6	175.7	35.9	66.7	39.0	40.5	0.18	14
216	3.9	5.1	2.1	15.8	45.0	0	8	182.3	44.5	34.7	26.5	26.5	0.31	18
217	3.9	5.1	2.1	14.3	41.5	0	9	161.7	42.9	49.7	17.2	19.0	0.42	40
218	3.9	5.1	2.1	14.0	39.5	0	9	168.3	38.3	66.4	37.4	42.2	0.31	8
219	3.9	5.1	2.1	13.8	49.0	0	9	125.8	39.3	60.9	15.6	17.9	0.18	6
220	3.9	5.1	2.1	14.3	41.5	0	10	170.4	39.6	41.9	29.6	32.7	0.38	7
221	3.9	5.1	2.1	15.5	44.5	0	6	173.9	37.9	71.1	42.1	42.9	0.37	58
222	3.9	5.1	2.1	13.6	40.0	0	6	153.4	42.2	96.6	42.1	48.9	0.27	25
223	3.9	5.1	2.1	14.1	40.5	0	11	173.5	42.9	60.8	32.8	36.8	0.13	15

(continued)

TABLE B-6. (continued)

Streetcar drivers

Subject	Air Lead µg/m³ M_G	Air Lead µg/m³ $\bar{X}$	Air Lead µg/m³ weighted average exposure	Blood Hb g %	Blood Htc cm³ %	Blood BpE per 10^6E	Blood Rtc %	Blood G-6PD units per 100mlE	Blood GSH mg per 100ml blood	Blood ALAD units per 1mlE	Blood Lead µg/100ml blood original values	Blood Lead µg/100ml blood standard Hb adjusted values	Urine ALA mg per 100ml	Urine Coproporphyrin µg per 100ml
224	3.9	5.1	2.1	15.4	45.0	0	10	138.9	32.3	105.8	37.4	38.4	0.42	13
225	3.9	5.1	2.1	15.5	44.5	0	7	149.8	36.6	73.0	28.1	28.6	0.18	15
226	3.9	5.1	2.1	14.9	43.0	0	12	181.3	37.6	15.4	37.4	39.7	0.27	10
227	3.9	5.1	2.1	14.8	42.5	0	6	184.2	43.2	11.2	35.9	38.3	0.12	12
228	3.9	5.1	2.1	15.4	45.0	0	9	139.0	40.5	11.4	25.0	25.6	0.50	18
229	3.9	5.1	2.1	15.1	44.0	0	10	156.1	33.9	19.9	15.6	16.3	0.47	7
230	3.9	5.1	2.1	16.5	46.5	0	9	167.6	38.9	19.4	23.4	22.4	0.34	6
231	3.9	5.1	2.1	14.7	42.5	0	7	171.1	33.9	33.8	15.6	16.8	0.33	9
232	3.9	5.1	2.1	15.4	45.5	0	9	173.9	38.3	30.8	14.0	14.4	0.44	14
233	3.9	5.1	2.1	15.3	44.5	0	8	196.8	38.3	32.3	0.0	0.0	0.34	11
234	3.9	5.1	2.1	14.9	43.0	0	10	171.4	35.6	12.5	10.9	11.6	0.31	18
235	3.9	5.1	2.1	15.5	45.0	0	6	190.0	39.9	12.5	25.0	25.5	0.24	17
236	3.9	5.1	2.1	15.0	43.5	0	10	214.1	29.0	31.0	21.8	23.0	0.10	35
237	3.9	5.1	2.1	15.1	44.0	0	7	175.2	34.9	60.5	35.9	37.6	0.44	8
238	3.9	5.1	2.1	15.4	45.0	0	10	181.8	34.6	12.8	26.5	27.2	0.17	13
239	3.9	5.1	2.1	14.5	43.0	0	8	164.5	41.9	10.2	29.6	32.3	0.37	12
240	3.9	5.1	2.1	15.9	46.0	0	6	187.4	35.9	19.8	18.7	18.6	0.14	7
241	3.9	5.1	2.1	15.0	44.5	0	10	196.8	32.3	21.9	21.8	23.0	0.47	5

(continued)

TABLE B-6. (continued)

Streetcar drivers

Subject	Air			Blood									Urine	
	Lead µg/m³										Lead µg/100ml blood			
	M_G	$\bar{X}$	weighted average exposure	Hb g %	Htc cm^3 %	BpE per 10^6E	Rtc %	G-6PD units per 100mlE	GSH mg per 100ml blood	ALAD units per 1mlE	original values	standard Hb adjusted values	ALA mg per 100ml	Copropor-phyrin µg per 100ml
242	3.9	5.1	2.1	14.0	39.5	0	10	178.2	37.3	19.0	15.6	17.6	0.38	19
243	3.9	5.1	2.1	15.2	44.5	0	6	157.3	39.9	42.1	26.5	27.5	0.63	54
244	3.9	5.1	2.1	14.4	41.0	0	12	161.9	36.3	37.5	10.9	12.0	0.27	7
245	3.9	5.1	2.1	15.2	44.5	0	10	153.0	37.9	46.3	15.6	16.2	0.24	18
246	3.9	5.1	2.1	15.5	45.0	0	10	155.8	34.3	30.8	21.8	22.2	0.27	12
247	3.9	5.1	2.1	16.1	46.0	0	8	146.6	36.6	42.1	31.2	30.6	0.21	6
248	3.9	5.1	2.1	16.2	47.0	0	7	156.0	29.0	31.9	17.2	16.8	0.54	6
249	3.9	5.1	2.1	16.0	46.0	0	9	154.0	36.9	34.8	12.5	12.3	0.34	7
250	3.9	5.1	2.1	14.9	43.5	0	8	157.8	41.3	65.2	14.0	14.8	0.63	4

TABLE B-7. RELATIONSHIP OF LEAD IN AIR TO BIOLOGICAL PARAMETERS - URBAN AREA

Customs officers

	Air			Blood									Urine	
	Lead µg/m³										Lead µg/100ml blood			
Subject	M_G	$\bar{X}$	weighted average exposure	Hb g %	Htc cm³ %	BpE per 10^6E	Rtc %	G-6PD units per 100mlE	GSH mg per 100ml blood	ALAD units per 1mlE	original values	standard Hb adjusted values	ALA mg per 100ml	Copropor-phyrin µg per 100ml
251	6.2	7.0	1.8	15.8	44.0	0	14	164.1	39.3	71.0	21.5	21.5	0.40	28
252	6.2	7.0	1.8	15.0	43.0	1200	20	190.4	35.0	84.3	10.9	11.5	0.40	17
253	6.2	7.0	1.8	14.9	42.5	0	10	185.5	32.7	69.1	9.9	10.5	0.46	21
254	6.2	7.0	1.8	16.3	45.5	0	15	187.7	35.6	115.1	12.9	12.5	0.36	13
255	6.2	7.0	1.8	12.6	43.0	0	13	194.0	33.8	115.6	5.6	7.0	0.51	20
256	6.2	7.0	1.8	15.9	45.0	0	12	159.8	36.3	77.7	9.3	9.2	0.46	3
257	6.2	7.0	1.8	16.8	46.5	900	19	174.5	37.6	48.4	7.0	6.6	0.52	7
258	6.2	7.0	1.8	16.4	46.0	0	15	175.5	37.0	56.5	9.9	9.5	0.44	22
259	6.2	7.0	1.8	15.3	43.0	0	12	188.1	35.9	82.8	7.2	7.4	0.36	14
260	6.2	7.0	1.8	13.6	40.0	0	14	199.0	40.3	62.5	14.2	16.5	0.38	17
261	6.2	7.0	1.8	14.2	43.0	0	14	170.1	41.6	42.1	7.6	8.5	0.71	30
262	6.2	7.0	1.8	13.9	41.5	300	18	210.4	36.3	62.0	11.3	12.8	0.33	4
263	6.2	7.0	1.8	13.1	39.0	0	14	181.3	27.7	63.1	8.6	10.4	0.46	1
264	6.2	7.0	1.8	15.4	43.0	0	16	189.0	37.9	53.7	10.9	11.2	0.40	41
265	6.2	7.0	1.8	15.3	43.5	900	21	194.5	30.4	35.9	6.6	6.8	0.40	35

(continued)

TABLE B-7. (continued)

Customs officers

Subject	Air Lead µg/m³ M_G	Air Lead µg/m³ $\bar{X}$	Air Lead µg/m³ weighted average exposure	Blood Hb g %	Blood Htc cm³ %	Blood BpE per 10^6E	Blood Rtc %	Blood G-6PD units per 100mlE	Blood GSH mg per 100ml blood	Blood ALAD units per 1mlE	Blood Lead µg/100ml blood original values	Blood Lead µg/100ml blood standard Hb adjusted values	Urine ALA mg per 100ml	Urine Copropor-phyrin µg per 100ml
266	6.2	7.0	1.8	13.9	41.0	0	13	204.3	37.9	31.0	7.3	8.3	0.40	32
267	6.2	7.0	1.8	16.6	45.5	800	20	200.9	37.6	83.7	8.6	8.2	0.36	20
268	6.2	7.0	1.8	16.1	44.5	1100	20	181.3	29.7	53.3	10.2	10.0	0.40	18
269	6.2	7.0	1.8	14.5	42.0	1000	20	190.7	34.3	58.6	12.3	13.4	0.40	26
270	6.2	7.0	1.8	15.0	42.0	0	14	188.8	29.7	75.0	5.6	5.9	0.52	30
271	6.2	7.0	1.8	16.2	45.0	400	18	196.4	31.4	76.3	11.3	11.0	0.45	15
272	6.2	7.0	1.8	15.1	42.5	700	19	187.7	33.7	56.7	11.9	12.5	0.37	35
273	6.2	7.0	1.8	16.2	45.5	0	13	183.1	35.0	79.1	7.0	6.8	0.33	19
274	6.2	7.0	1.8	16.6	46.0	2300	30	185.4	32.3	112.7	8.3	7.9	0.28	24
275	6.2	7.0	1.8	16.8	46.5	1500	21	190.9	30.4	72.0	8.3	7.8	0.40	22
276	6.2	7.0	1.8	16.1	45.0	0	15	187.6	33.0	54.7	6.3	6.2	0.33	25
277	6.2	7.0	1.8	17.9	49.0	1600	22	166.8	33.0	59.9	7.0	6.2	0.42	23
278	6.2	7.0	1.8	16.4	46.0	1200	20	205.4	34.7	78.8	8.6	8.3	0.46	34
279	6.2	7.0	1.8	15.7	44.0	0	11	209.1	41.3	82.3	4.7	4.7	0.40	10
280	6.2	7.0	1.8	15.0	44.0	1700	24	187.8	37.9	64.7	6.3	6.6	0.46	43
281	6.2	7.0	1.8	16.4	46.0	0	17	180.9	39.6	73.3	8.6	8.3	0.46	34
282	6.2	7.0	1.8	16.6	47.0	0	14	194.3	38.9	71.8	12.3	11.8	0.46	11
283	6.2	7.0	1.8	16.8	47.5	0	14	159.4	37.9	76.6	10.3	9.7	0.57	25

(continued)

TABLE B-7. (continued)

Customs officers

Subject	Air: Lead µg/m³ M_G	Air: Lead µg/m³ $\bar{X}$	Air: Lead µg/m³ weighted average exposure	Blood: Hb g %	Blood: Htc cm³ %	Blood: BpE per 10^6E	Blood: Rtc %	Blood: G-6PD units per 100mlE	Blood: GSH mg per 100ml blood	Blood: ALAD units per 1mlE	Blood: Lead µg/100ml blood: original values	Blood: Lead µg/100ml blood: standard Hb adjusted values	Urine: ALA mg per 100ml	Urine: Coproporphyrin µg per 100ml
284	6.2	7.0	1.8	16.3	45.5	1700	24	166.1	36.3	107.6	12.9	12.5	0.56	17
285	6.2	7.0	1.8	15.3	44.5	400	18	201.3	40.9	78.9	6.6	6.8	0.43	16
286	6.2	7.0	1.8	14.8	42.5	0	10	183.2	39.3	87.0	11.3	12.1	0.56	22
287	6.2	7.0	1.8	16.7	47.0	0	11	188.3	34.7	80.8	14.9	14.1	0.56	20
288	6.2	7.0	1.8	15.2	44.0	0	16	178.1	33.0	82.9	11.9	12.4	0.59	9
289	6.2	7.0	1.8	15.9	44.5	0	10	211.3	34.3	65.1	12.9	12.8	0.40	12
290	6.2	7.0	1.8	13.7	41.0	0	14	202.4	40.3	65.5	11.6	13.4	0.42	10
291	6.2	7.0	1.8	14.8	43.5	0	15	181.6	36.7	69.5	8.3	8.9	0.34	16
292	6.2	7.0	1.8	16.8	47.5	0	13	189.0	34.3	45.5	13.6	12.8	0.36	13
293	6.2	7.0	1.8	15.2	44.5	0	14	163.4	36.3	64.3	8.9	9.3	0.28	15
294	6.2	7.0	1.8	17.5	48.0	1700	25	207.2	37.6	151.0	4.6	4.2	0.33	22
295	6.2	7.0	1.8	15.7	45.5	300	18	190.8	34.3	74.7	12.9	13.0	0.44	29
296	6.2	7.0	1.8	15.9	44.5	1100	20	203.8	36.3	81.4	18.2	18.0	0.40	22
297	6.2	7.0	1.8	15.7	45.0	0	14	170.9	36.3	46.3	8.6	8.7	0.34	16
298	6.2	7.0	1.8	16.4	46.5	400	18	196.0	34.3	56.4	8.9	8.6	0.40	25
299	6.2	7.0	1.8	15.3	45.0	1700	21	180.0	39.3	44.4	9.3	9.6	0.26	15
300	6.2	7.0	1.8	14.4	43.0	0	10	165.9	35.0	69.1	9.9	10.9	0.40	12
301	6.2	7.0	1.8	16.8	47.5	0	13	180.8	37.6	55.9	8.6	8.1	0.46	25

(continued)

TABLE B-7. (continued)

Customs officers

Subject	Air			Blood									Urine	
	Lead µg/m³										Lead µg/100ml blood			
	M_G	$\bar{X}$	weighted average exposure	Hb g %	Htc cm^3 %	BpE per 10^6E	Rtc %	G-6PD units per 100mlE	GSH mg per 100ml blood	ALAD units per 1mlE	original values	standard Hb adjusted values	ALA mg per 100ml	Coproporphyrin µg per 100ml
302	6.2	7.0	1.8	15.5	45.0	0	14	164.3	33.0	64.4	10.3	10.5	0.52	13
303	6.2	7.0	1.8	15.2	44.0	0	18	188.7	34.3	64.2	8.0	8.3	0.26	20
304	6.2	7.0	1.8	12.6	39.0	1800	25	178.3	36.3	31.7	9.6	12.0	0.23	13
305	6.2	7.0	1.8	14.2	43.0	0	12	193.4	32.7	43.6	9.3	10.3	0.57	21
306	6.2	7.0	1.8	15.3	42.5	0	15	201.7	35.6	39.7	8.3	8.6	0.25	25
307	6.2	7.0	1.8	14.6	44.0	0	12	208.2	37.6	72.7	9.9	10.7	0.22	13
308	6.2	7.0	1.8	17.0	47.5	2200	24	188.0	39.3	110.5	12.3	11.4	0.37	30
309	6.2	7.0	1.8	14.8	42.5	0	15	170.8	34.3	76.4	10.9	11.6	0.34	18
310	6.2	7.0	1.8	15.3	45.0	0	13	206.0	37.6	69.3	12.3	12.7	0.23	15
311	6.2	7.0	1.8	13.9	41.0	0	15	188.0	36.3	118.9	15.6	17.7	0.42	13
312	6.2	7.0	1.8	16.4	46.0	0	12	201.7	37.0	48.3	11.9	11.5	0.26	10
313	6.2	7.0	1.8	8.0	31.0	1000	22	185.7	36.0	46.9	7.3	12.8	0.28	30
314	6.2	7.0	1.8	16.0	46.0	0	13	181.7	37.0	73.9	18.1	17.9	0.33	8
315	6.2	7.0	1.8	14.6	44.5	1300	23	206.6	41.3	94.3	9.9	10.7	0.26	11
316	6.2	7.0	1.8	17.5	48.0	1300	22	210.0	37.9	33.8	15.9	14.4	0.46	34
317	6.2	7.0	1.8	14.9	44.0	2600	27	188.1	39.6	70.4	7.6	8.1	0.26	12
318	6.2	7.0	1.8	16.7	47.0	1500	25	175.1	38.9	80.3	11.6	11.0	0.30	30

(continued)

TABLE B-7. (continued)

Customs officers

Subject	Air			Blood									Urine	
	Lead µg/m³										Lead µg/100ml blood			
	M_G	$\bar{X}$	weighted average exposure	Hb g %	Htc cm³ %	BpE per 10^6E	Rtc %	G-6PD units per 100mlE	GSH mg per 100ml blood	ALAD units per 1mlE	original values	standard Hb adjusted values	ALA mg per 100ml	Coproporphyrin µg per 100ml
319	6.2	7.0	1.8	17.1	47.5	0	15	187.9	37.9	69.7	11.3	10.4	0.26	24
320	6.2	7.0	1.8	16.4	46.0	1000	22	160.1	36.3	63.8	15.6	15.0	0.40	15
321	6.2	7.0	1.8	17.2	48.0	1400	20	201.4	34.7	61.9	15.2	14.0	0.16	20
322	6.2	7.0	1.8	15.7	46.0	0	12	190.8	33.0	53.8	11.6	11.7	0.20	13
323	6.2	7.0	1.8	15.3	45.5	0	14	188.1	34.3	79.6	11.3	11.7	0.27	15
324	6.2	7.0	1.8	15.3	45.0	0	10	170.5	37.6	71.3	15.2	15.7	0.26	13
325	6.2	7.0	1.8	15.5	45.5	0	13	164.8	32.7	54.3	10.9	11.1	0.23	14

TABLE B-8. RELATIONSHIP OF LEAD IN AIR TO BIOLOGICAL PARAMETERS - URBAN AREA

Traffic policemen

	Air			Blood									Urine	
	Lead µg/m³										Lead µg/100ml blood			
Subject	M_G	$\bar{X}$	weighted average exposure	Hb g %	Htc cm³ %	BpE per 10^6E	Rtc %	G-6PD units per 100mlE	GSH mg per 100ml blood	ALAD units per 1mlE	original values	standard Hb adjusted values	ALA mg per 100ml	Coproporphyrin µg per 100ml
326	8.2	9.9	3.0	15.9	45.0	0	9	150.5	33.0	65.5	4.6	4.6	0.23	20
327	8.2	9.9	3.0	16.5	46.0	0	12	178.9	34.7	58.4	3.6	3.4	0.25	13
328	8.2	9.9	3.0	16.2	45.0	0	10	157.5	36.3	76.1	11.6	11.3	0.33	20
329	8.2	9.9	3.0	16.9	47.0	0	9	166.8	37.6	102.6	4.3	4.0	0.38	14
330	8.2	9.9	3.0	16.6	46.0	0	11	173.5	39.6	104.0	6.6	6.3	0.36	19
331	8.2	9.9	3.0	15.8	44.0	0	10	161.6	34.3	78.4	6.3	6.3	0.28	11
332	8.2	9.9	3.0	16.5	46.0	0	9	170.2	37.9	105.9	5.0	4.8	0.25	15
333	8.2	9.9	3.0	16.8	47.0	0	10	170.5	36.3	61.9	15.9	14.9	0.40	15
334	8.2	9.9	3.0	14.4	42.0	0	11	162.9	38.9	69.0	18.9	20.7	0.38	23
335	8.2	9.9	3.0	14.3	41.0	0	11	171.9	35.0	82.6	13.6	15.0	0.27	6
336	8.2	9.9	3.0	15.8	45.0	200	15	173.1	32.7	87.5	11.9	11.9	0.34	19
337	8.2	9.9	3.0	13.9	42.0	0	14	155.2	33.6	102.3	17.9	20.3	0.26	9
338	8.2	9.9	3.0	16.8	47.0	0	9	175.0	38.9	72.0	15.6	14.7	0.25	16
339	8.2	9.9	3.0	16.9	48.0	0	14	189.4	37.9	86.7	16.9	15.8	0.23	16
340	8.2	9.9	3.0	16.3	46.0	800	18	175.6	36.3	65.4	15.6	15.1	0.30	28

(continued)

TABLE B-8. (continued)

Traffic policemen

Subject	Air			Blood									Urine	
	Lead µg/m³										Lead µg/100ml blood			
	M_G	$\bar{X}$	weighted average exposure	Hb g %	Htc cm^3 %	BpE per 10^6E	Rtc %	G-6PD units per 100mlE	GSH mg per 100ml blood	ALAD units per 1mlE	original values	standard Hb adjusted values	ALA mg per 100ml	Copropor-phyrin µg per 100ml
341	8.2	9.9	3.0	16.5	46.0	300	13	154.8	39.3	125.8	12.9	12.4	0.36	39
342	8.2	9.9	3.0	15.8	44.5	0	12	153.2	36.3	52.2	12.3	12.3	0.33	8
343	8.2	9.9	3.0	15.6	44.0	0	9	148.9	33.0	59.6	9.9	10.0	0.28	15
344	8.2	9.9	3.0	15.8	45.0	0	11	184.0	34.9	59.1	18.2	18.2	0.46	10
345	8.2	9.9	3.0	15.1	42.5	600	19	189.0	34.3	64.4	7.6	8.0	0.33	12
346	8.2	9.9	3.0	15.4	43.0	600	17	160.0	34.7	72.3	11.2	11.5	0.28	5
347	8.2	9.9	3.0	16.5	45.0	0	14	176.0	47.0	98.3	10.9	10.4	0.23	8
348	8.2	9.9	3.0	16.5	45.5	0	10	178.0	33.0	123.9	13.2	12.6	0.34	7
349	8.2	9.9	3.0	14.7	42.0	0	13	188.4	34.7	116.6	10.3	11.1	0.40	6
350	8.2	9.9	3.0	15.3	44.0	0	13	170.2	39.9	117.8	12.6	13.0	0.75	15
351	8.2	9.9	3.0	15.3	43.5	0	11	180.0	41.5	94.2	23.8	24.6	0.30	4
352	8.2	9.9	3.0	16.9	45.0	0	15	194.2	33.0	119.4	17.6	16.5	0.46	5

(continued)

TABLE B-9. RELATIONSHIP OF LEAD IN AIR TO BIOLOGICAL PARAMETERS - LEAD SMELTERY AREA

Meza Valley inhabitants - no occupational exposure

	Air			Blood									Urine	
	Lead µg/m³										Lead µg/100ml blood			
Subject	M_G	$\bar{X}$	weighted average exposure	Hb g %	Htc cm³ %	BpE per 10^6E	Rtc %	G-6PD units per 100mlE	GSH mg per 100ml blood	ALAD units per 1mlE	original values	standard Hb adjusted values	ALA mg per 100ml	Coproporphyrin µg per 100ml
353	21.0	44.0	22.0	15.9	42.0	0	12	158.2	41.3	46.7	25.8	25.6	1.18	34
354	21.0	44.0	22.0	17.2	43.0	600	18	180.0	46.2	44.8	34.7	31.9	0.34	15
355	21.0	44.0	22.0	16.7	48.0	0	13	160.9	52.5	23.7	36.6	34.6	0.38	19
356	21.0	44.0	22.0	17.9	44.0	0	12	172.8	32.7	16.8	37.4	33.0	0.77	32
357	21.0	44.0	22.0	18.8	47.0	4400	43	183.1	34.3	13.3	30.5	25.6	0.52	28
358	21.0	44.0	22.0	16.2	47.0	1600	19	166.2	35.0	10.1	44.5	43.4	2.09	40
359	21.0	44.0	22.0	15.2	45.0	1600	21	162.8	33.3	77.8	27.9	29.0	0.33	11
360	21.0	44.0	22.0	16.1	48.0	2100	22	174.1	35.0	16.7	37.9	37.2	1.25	39
361	21.0	44.0	22.0	14.4	46.0	1900	22	171.0	40.3	29.9	35.8	39.3	1.19	38
362	21.0	44.0	22.0	16.5	47.0	0	14	191.5	42.2	41.8	32.9	31.5	0.77	23
363	21.0	44.0	22.0	15.5	44.5	500	18	196.1	46.2	16.9	27.9	28.4	0.79	9
364	21.0	44.0	22.0	16.4	46.0	2000	21	175.5	45.2	14.2	42.6	41.0	1.64	42
365	21.0	44.0	22.0	13.7	44.0	0	15	174.5	38.3	29.8	33.7	38.9	0.67	20
366	21.0	44.0	22.0	15.6	44.0	3700	34	167.9	38.0	31.3	29.2	29.6	0.54	17
367	21.0	44.0	22.0	19.4	41.0	2400	20	162.3	47.9	32.3	24.0	19.5	0.42	30

(continued)

TABLE B-9. (continued)

Meza Valley inhabitants - no occupational exposure

Subject	Air: Lead µg/m³ M_G	Air: Lead µg/m³ $\bar{X}$	Air: Lead µg/m³ weighted average exposure	Blood: Hb g %	Blood: Htc cm³ %	Blood: BpE per 10^6E	Blood: Rtc %	Blood: G-6PD units per 100mlE	Blood: GSH mg per 100ml blood	Blood: ALAD units per 1mlE	Blood: Lead µg/100ml blood: original values	Blood: Lead µg/100ml blood: standard Hb adjusted values	Urine: ALA mg per 100ml	Urine: Coproporphyrin µg per 100ml
368	29.0	36.0	17.0	17.8	46.0	2100	23	188.1	44.6	37.5	28.7	25.5	0.78	13
369	33.0	55.0	26.0	16.5	45.0	0	13	161.1	49.2	25.6	38.2	36.6	0.68	29
370	29.0	36.0	17.0	16.3	44.0	0	12	173.6	33.3	16.8	41.1	39.8	0.22	136
371	29.0	36.0	17.0	17.8	48.0	1800	22	170.5	50.8	15.6	33.4	29.6	0.77	19
372	33.0	55.0	26.0	16.3	45.0	0	14	165.0	36.3	25.8	29.0	28.1	0.19	4
373	33.0	55.0	26.0	14.7	45.0	0	11	162.3	39.3	18.1	32.4	34.8	0.88	22
374	33.0	55.0	26.0	13.5	44.0	300	16	176.1	33.7	31.3	41.1	48.1	0.79	12
375	33.0	55.0	26.0	16.6	45.5	1000	18	170.4	41.3	33.2	28.2	26.8	0.35	13
376	33.0	55.0	26.0	16.0	45.5	300	16	195.0	43.2	25.0	31.1	30.7	0.63	28
377	33.0	55.0	26.0	12.9	45.0	0	13	175.2	37.3	10.0	30.5	37.4	0.67	22
378	24.0	29.0	14.0	15.0	44.5	600	15	181.0	32.0	25.0	32.4	34.1	0.45	13
379	24.0	29.0	14.0	14.5	45.0	0	8	173.0	36.6	40.8	22.6	24.6	0.31	11
380	24.0	29.0	14.0	15.3	46.0	800	17	169.8	34.7	24.5	18.7	19.3	0.56	16
381	24.0	29.0	14.0	14.8	43.0	0	13	164.3	35.3	63.9	29.7	31.7	0.29	11
382	24.0	29.0	14.0	15.6	45.0	0	14	168.2	44.6	63.9	28.4	28.8	0.48	10
383	24.0	29.0	14.0	16.0	43.5	0	13	179.5	41.3	59.7	35.8	35.4	0.61	12
384	24.0	29.0	14.0	15.6	43.0	400	16	166.1	42.2	48.8	19.2	19.4	0.74	7

TABLE B-10. RELATIONSHIP OF OCCUPATIONAL EXPOSURE TO BIOLOGICAL PARAMETERS

Meza Valley inhabitants - working close to the lead smeltery or previous occupational exposure

	Air			Blood										Urine	
	Lead µg/m³										Lead µg/100ml blood				
Subject	M_G	$\bar{X}$	weighted average exposure	Hb g %	Htc cm³ %	BpE per 10^6E	Rtc %	G-6PD units per 100mlE	GSH mg per 100ml blood	ALAD units per 1mlE	original values	standard Hb adjusted values	ALA mg per 100ml	Copropor-phyrin µg per 100ml
385	21.0	44.0	22.0	16.7	45.0	0	13	156.0	64.4	25.0	80.5	76.2	0.50	15
386	21.0	44.0	22.0	18.7	45.5	0	15	180.2	39.9	44.8	40.0	33.8	0.50	19
387	21.0	44.0	22.0	18.3	46.0	3000	21	196.6	41.6	7.9	80.5	69.5	2.55	64
388	33.0	55.0	26.0	16.2	49.0	3900	30	193.4	34.3	11.5	77.4	75.5	0.12	70
389	21.0	44.0	22.0	14.8	46.0	1100	19	200.1	46.5	10.6	62.4	66.6	1.76	48
390	21.0	44.0	22.0	17.2	48.0	0	14	171.8	39.9	17.4	55.8	51.3	0.92	36
391	29.0	36.0	17.0	16.7	40.5	0	14	169.0	39.9	20.5	70.5	66.7	0.84	16
392	29.0	36.0	17.0	16.5	45.0	0	15	164.8	43.9	31.3	52.4	49.6	1.19	21
393	29.0	36.0	17.0	14.0	44.5	0	11	176.1	34.9	25.3	45.5	51.4	0.61	21
394	29.0	36.0	17.0	15.9	45.0	500	16	165.2	48.5	12.5	78.8	78.3	0.96	21
395	24.0	29.0	14.0	15.9	44.0	1000	18	171.0	33.3	31.5	55.3	55.0	0.81	25
396	24.0	29.0	14.0	15.8	45.0	1800	20	163.2	34.3	19.2	71.1	71.1	0.12	1
397	21.0	44.0	22.0	17.1	44.0	0	13	175.1	36.6	13.6	91.6	84.6	0.89	43
398	21.0	44.0	22.0	16.4	46.0	0	9	160.0	48.5	16.3	60.3	58.1	0.64	23

(continued)

TABLE B-10. (continued)

Meza Valley inhabitants - working close to the lead smeltery or previous occupational exposure

Subject	Air Lead µg/m³ M_G	$\bar{X}$	weighted average exposure	Blood Hb g %	Htc cm³ %	BpE per 10^6E	Rtc %	G-6PD units per 100mlE	GSH mg per 100ml blood	ALAD units per 1mlE	Lead µg/100ml blood original values	Lead µg/100ml blood standard Hb adjusted values	Urine ALA mg per 100ml	Urine Coproporphyrin µg per 100ml
399	21.0	44.0	22.0	17.7	46.5	2000	18	160.8	36.0	16.9	46.9	41.9	0.60	35
400	21.0	44.0	22.0	18.6	46.5	3900	25	193.1	30.0	18.8	63.2	53.7	1.52	40
401	27.7	41.0	20.0	16.8	45.0	1400	19	176.2	34.7	5.6	74.5	70.1	0.54	49
402	21.0	44.0	22.0	16.1	45.0	1200	20	174.8	41.9	10.0	76.9	75.5	1.50	68
403	21.0	44.0	22.0	17.8	45.0	2600	28	186.9	68.3	6.1	79.2	70.3	0.25	15
404	21.0	44.0	22.0	17.0	46.0	3000	26	169.5	39.3	6.8	94.5	87.8	5.35	70
405	29.0	36.0	17.0	12.2	50.0	3400	24	163.2	36.3	9.5	82.4	106.7	3.17	53
406	29.0	36.0	17.0	14.1	44.0	3400	29	165.4	45.5	9.4	72.9	81.7	1.24	12
407	29.0	36.0	17.0	17.7	45.0	500	16	175.0	32.0	20.0	33.4	33.6	0.58	19
408	29.0	36.0	17.0	16.2	43.0	4000	26	181.3	34.2	7.8	70.3	68.6	8.32	204
409	29.0	36.0	17.0	16.2	46.0	400	15	165.8	38.0	30.9	49.0	47.8	0.70	30
410	24.0	29.0	14.0	15.2	45.0	3500	25	182.2	40.9	6.9	53.2	55.3	1.41	34
411	24.0	29.0	14.0	14.9	44.0	400	14	190.0	38.3	19.3	67.9	72.0	0.84	22
412	24.0	29.0	14.0	18.8	45.5	1000	18	171.0	34.0	47.3	42.9	36.1	0.41	16
413	24.0	29.0	14.0	15.3	44.0	1600	20	180.5	39.9	15.6	61.1	63.1	1.01	17
414	24.0	29.0	14.0	16.3	45.0	2400	22	165.5	30.0	5.2	68.4	70.6	2.34	76
415	24.0	29.0	14.0	15.7	45.5	0	15	175.2	37.6	32.1	46.1	46.4	0.64	15

(continued)

TABLE B-10. (continued)

Meza Valley Inhabitants - working close to the lead smeltery or previous occupational exposure

Subject	Air: Lead µg/m³ M_G	Air: Lead µg/m³ $\bar{X}$	Air: Lead µg/m³ weighted average exposure	Blood: Hb g %	Blood: Htc cm³ %	Blood: BpE per 10^6E	Blood: Rtc %	Blood: G-6PD units per 100mlE	Blood: GSH mg per 100ml blood	Blood: ALAD units per 1mlE	Blood: Lead µg/100ml blood original values	Blood: Lead µg/100ml blood standard Hb adjusted values	Urine: ALA mg per 100ml	Urine: Coproporphyrin µg per 100ml
416	24.0	29.0	14.0	16.0	46.0	0	12	169.8	39.6	33.2	47.6	47.0	0.46	16
417	24.0	29.0	14.0	13.8	43.5	2500	21	175.5	50.2	10.9	52.4	60.0	1.36	40
418	24.0	29.0	14.0	14.0	44.5	2600	24	179.0	33.7	3.1	96.1	108.5	1.65	39
419	24.0	29.0	14.0	13.9	43.0	2100	20	183.8	34.9	35.5	49.7	56.5	0.65	17
420	24.0	29.0	14.0	17.3	44.5	1400	19	177.1	36.0	13.8	57.9	52.9	0.44	7
421	24.0	29.0	14.0	13.9	40.5	400	15	182.0	35.6	18.5	43.1	49.0	0.36	11
422	24.0	29.0	14.0	14.9	45.0	600	16	180.8	42.9	58.6	61.3	65.0	0.37	13
423	24.0	29.0	14.0	17.0	43.0	1600	20	171.2	36.0	8.1	54.0	50.2	4.65	82
424	24.0	29.0	14.0	16.4	45.0	0	14	176.2	45.2	59.4	40.3	38.8	0.45	6
425	24.0	29.0	14.0	15.5	44.5	0	8	175.5	36.3	32.8	58.2	59.3	0.50	4
426	24.0	29.0	14.0	13.7	43.0	600	17	169.2	36.6	14.5	68.2	78.7	0.95	21

TABLE B-11. RELATIONSHIP OF LEAD IN AIR TO BIOLOGICAL PARAMETERS - OCCUPATIONAL EXPOSURE

Lead article manufacture (TOP)

Subject	Air		Blood									Urine	
	Lead µg/m³									Lead µg/100ml blood			
	personal occupational	weighted average exposure	Hb g %	Htc cm³ %	BpE per 10^6E	Rtc %	G-6PD units per 100mlE	GSH mg per 100ml blood	ALAD units per 1mlE	original values	standard Hb adjusted values	ALA mg per 100ml	Corproporphyrin µg per 100ml
427	145.0	36.0	13.4	40.0	0	12	220.5	39.3	10.0	12.7	15.0	0.85	8
428	126.0	80.0	15.6	45.0	1200	20	156.1	37.6	26.3	46.3	46.9	0.63	23
429	559.0	80.0	14.8	44.0	600	15	205.8	36.3	10.5	33.3	35.6	0.25	13
430	62.0	80.0	16.3	46.0	0	12	183.5	38.3	6.7	47.6	46.1	0.77	34
431	132.0	80.0	15.2	44.0	0	10	220.5	40.9	3.9	25.4	26.4	2.68	39
432	794.0	80.0	15.1	43.0	1000	18	180.9	28.5	8.1	14.6	15.3	0.14	26
433	247.0	80.0	15.5	45.0	500	10	229.6	34.7	6.1	31.7	32.3	1.10	22
434	289.0	55.0	15.0	44.0	2800	19	195.9	37.9	7.6	48.8	51.4	0.29	17
435	331.0	55.0	14.1	43.0	900	16	152.4	39.6	27.3	19.7	22.1	0.27	20
436	343.0	55.0	15.1	44.0	900	16	191.7	29.7	1.9	52.0	54.4	1.56	116
437	245.0	55.0	15.9	45.0	0	12	247.4	40.3	5.8	36.5	36.3	0.27	40
438	302.0*	55.0†	14.6	44.5	1800	16	189.2	37.6	9.8	39.6	42.9	0.37	26
439	189.0	55.0	16.7	47.0	1400	17	146.9	34.7	10.8	16.4	15.5	0.34	17

* The mean occupational exposure at the working place.

† The weighted average exposures have been calculated from data at the working place and from the average indoor and outdoor exposure at home.

(continued)

TABLE B-11. (continued)

Lead article manufacture (TOP)

Subject	Air: Lead µg/m³ personal occupational	Air: Lead µg/m³ weighted average exposure	Blood: Hb g %	Blood: Htc cm³ %	Blood: BpE per 10^6E	Blood: Rtc %	Blood: G-6PD units per 100mlE	Blood: GSH mg per 100ml blood	Blood: ALAD units per 1mlE	Blood: Lead µg/100ml blood: original values	Blood: Lead µg/100ml blood: standard Hb adjusted values	Urine: ALA mg per 100ml	Urine: Corproporphyrin µg per 100ml
440	185.0	55.0	14.5	43.0	4800	25	179.3	34.3	10.4	62.8	68.5	0.69	14
441	317.0	55.0	14.8	43.0	900	17	174.1	37.9	15.6	26.0	27.8	0.38	17
442	123.0	55.0	16.2	46.0	0	10	141.1	37.6	5.4	41.8	40.8	0.15	7
443	171.0	55.0	15.7	46.0	0	12	161.9	41.3	19.0	29.8	30.0	0.30	19
444	152.0	30.0	16.3	46.0	1100	16	159.2	39.6	11.4	22.2	21.5	0.78	19
445	113.0	28.0	13.9	40.0	0	12	171.1	38.9	15.5	38.7	44.0	0.55	29
446	154.0	30.0	14.8	43.0	2200	18	204.0	41.3	10.1	20.9	22.3	0.27	17
447	119.0	30.0	14.6	41.0	500	14	177.0	36.7	14.3	54.5	59.0	0.44	7
448	174.0	46.0	15.9	46.0	900	18	185.2	33.0	27.7	65.3	64.9	0.44	13
449	168.0	46.0	17.0	46.0	2000	18	172.5	33.0	38.0	65.3	60.7	0.58	15
450	205.0	46.0	14.1	41.5	2600	22	196.3	30.4	11.1	42.5	47.6	0.38	13
451	129.0	32.0	15.9	45.5	0	15	187.6	34.7	36.0	66.6	66.2	1.29	65
452	129.0*	32.0†	14.0	42.0	1200	16	227.2	33.0	2.7	34.2	38.6	0.17	11
453	150.0*	38.0†	15.9	45.0	0	16	210.2	36.3	33.6	46.3	46.0	0.41	17
454	327.0*	82.0†	13.7	42.0	1900	19	177.1	34.7	3.2	68.5	79.0	0.82	30
455	279.0	82.0	13.7	42.0	1600	19	221.1	31.4	4.1	52.6	60.7	0.62	39
456	327.0*	82.0†	14.8	42.0	1500	19	208.5	32.3	4.4	57.7	61.6	1.03	39
457	375.0	82.0	14.6	43.0	1900	18	209.6	36.3	16.5	41.2	44.6	0.34	17
458	327.0*	82.0†	14.4	42.0	600	16	172.1	33.0	5.3	33.0	36.2	0.27	10

* The mean occupational exposure at the working place.

† The weighted average exposures have been calculated from data at the working place and from the average indoor and outdoor exposure at home.

(continued)

TABLE B-11. (continued)

Lead article manufacture (TOP)

Subject	Air: Lead µg/m³ personal occupational	Air: Lead µg/m³ weighted average exposure	Blood: Hb g %	Blood: Htc cm³ %	Blood: BpE per 10^6E	Blood: Rtc %	Blood: G-6PD units per 100mlE	Blood: GSH mg per 100ml blood	Blood: ALAD units per 1mlE	Blood: Lead µg/100ml blood original values	Blood: Lead µg/100ml blood standard Hb adjusted values	Urine: ALA mg per 100ml	Urine: Corproporphyrin µg per 100ml
459	46.0	24.0	15.5	46.0	0	12	165.2	37.9	11.6	59.0	60.1	0.21	28
460	100.0*	25.0†	16.9	46.5	0	10	167.4	31.4	4.0	72.3	60.5	0.49	12
461	848.0	212.0	15.5	43.5	0	15	157.0	33.0	5.7	33.0	33.6	0.56	36
462	100.0*	25.0†	15.0	44.0	3600	23	176.5	34.0	10.5	46.3	48.8	0.00	9
463	100.0*	25.0†	14.4	43.0	900	16	218.4	27.7	7.5	57.1	62.7	0.70	9
464	155.0	25.0	15.2	44.0	1500	18	208.4	37.9	9.3	60.2	62.6	0.33	6
465	100.0*	25.0†	13.4	41.5	500	14	143.5	31.7	5.4	62.0	73.1	0.38	12
466	100.0*	25.0†	14.8	42.5	1200	17	193.7	34.3	5.2	33.3	35.6	0.30	55
467	100.0*	25.0†	13.0	40.0	800	16	172.5	37.9	11.5	24.1	29.3	0.76	17
468	52.0	16.0	15.0	43.0	0	15	175.8	31.4	11.3	43.7	46.0	0.34	13
469	47.0	13.0	14.4	42.0	3000	20	150.5	33.7	2.3	52.6	51.7	1.56	21
470	55.0	13.0	15.4	43.5	300	14	193.1	35.0	2.6	36.8	37.8	0.56	53
471	100.0*	25.0†	14.6	44.0	800	16	152.5	37.9	7.8	60.9	65.9	0.14	8
472	100.0*	25.0†	15.5	46.0	2000	21	176.4	29.7	3.2	63.4	65.0	1.04	13
473	100.0*	25.0†	15.4	44.0	800	16	204.4	34.7	5.9	49.5	50.8	0.48	13

* The mean occupational exposure at the working place.

† The weighted average exposures have been calculated from the data at the working place and from the average indoor and outdoor exposure at home.

TABLE 3-12. RELATIONSHIP OF OCCUPATIONAL EXPOSURE TO BIOLOGICAL PARAMETERS

Lead storage battery plant (Munja II)

Subject	Air		Blood									Urine	
	Lead µg/m³									Lead µg/100ml blood			
	personal occupational	weighted average exposure	Hb g %	Htc cm³ %	BpE per 10^6E	Rtc %	G-6PD units per 100mlE	GSH mg per 100ml blood	ALAD units per 1mlE	original values	standard Hb adjusted values	ALA mg per 100ml	Corproporphyrin µg per 100ml
474	120.0	164.0	15.8	46.3	0	15	161.8	33.0	46.3	69.1	69.1	0.13	10
475	310.0	164.0	16.6	46.5	0	10	174.8	36.3	4.0	42.5	40.5	0.56	15
476	880.0	164.0	15.6	44.0	0	10	191.7	39.6	25.0	52.6	53.3	0.27	16
477	410.0	164.0	15.8	45.0	0	8	255.7	40.9	13.3	44.4	44.4	0.32	32
478	340.0	164.0	14.4	43.0	0	9	209.8	44.5	32.2	36.8	40.4	0.42	14
479	1240.0	164.0	14.3	42.0	0	9	144.1	46.2	12.0	11.4	12.6	0.56	29
480	490.0	186.0	14.9	43.5	0	15	149.3	32.0	12.6	59.0	62.6	0.51	38
481	3150.0	720.0	14.3	42.0	0	15	181.3	28.1	8.0	59.6	65.9	0.61	38
482	1580.0	720.0	15.4	43.0	0	12	162.4	30.2	22.6	15.9	16.3	0.44	14
483	610.0	186.0	14.6	41.5	500	18	187.6	26.4	9.0	53.9	58.3	0.40	22
484	60.0	88.0	15.1	44.5	0	18	179.9	33.0	33.7	64.7	67.7	0.65	18
485	140.0	88.0	15.0	44.0	0	16	166.5	44.5	28.4	61.5	64.8	0.28	19
486	120.0	88.0	16.2	47.0	0	15	161.6	37.0	18.0	64.7	63.1	0.32	16
487	1430.0	418.0	14.9	43.5	800	19	180.2	31.7	12.0	50.7	53.8	0.81	10
488	980.0	88.0	14.8	[illegible]	0	15	185.2	41.2	22.7	26.6	28.4	0.64	8

(continued)

TABLE B-12. (continued)

Lead storage battery plant (Munja II)

Subject	Air		Blood							Urine			
	Lead µg/m³									Lead µg/100ml blood			
	personal occupational	weighted average exposure	Hb g %	Htc cm³ %	BpE per 10^6E	Rtc %	G-6PD units per 100mlE	GSH mg per 100ml blood	ALAD units per 1mlE	original values	standard Hb adjusted values	ALA mg per 100ml	Corproporphyrin µg per 100ml
489	160.0	88.0	14.2	43.0	0	17	157.2	39.7	11.3	20.9	23.3	0.52	37
490	1800.0	597.0	11.9	36.0	800	18	223.3	36.3	12.1	54.5	72.4	0.28	47
491	3170.0	497.0	15.2	44.5	500	15	186.2	35.0	5.6	69.1	71.7	0.55	15
492	230.0	64.0	13.4	41.0	500	17	162.0	34.0	16.4	67.2	79.2	1.32	27
493	730.0	269.0	15.2	43.0	0	16	174.1	36.6	35.0	7.6	7.9	0.40	16
494	190.0	63.0	14.1	41.0	0	14	188.5	32.0	21.3	68.5	76.8	0.28	8
495	110.0	33.0	14.8	43.0	0	15	178.9	34.3	20.3	11.4	12.2	0.84	8
496	20.0	7.0	15.6	45.0	0	12	183.9	34.4	30.5	44.4	45.0	0.50	9
497	340.0	97.0	15.7	46.0	0	10	180.7	32.0	29.0	67.8	68.2	0.65	12
498	340.0	97.0	16.7	47.5	0	11	188.2	36.3	24.5	7.0	6.6	1.35	20
499	310.0	97.0	15.4	44.5	0	10	196.6	32.6	26.7	24.7	25.3	1.07	26
500	620.0	182.0	10.3	36.0	400	16	168.1	37.6	36.1	43.7	67.0	0.51	15
501	230.0	68.0	12.8	40.5	0	11	171.1	32.0	34.9	63.4	78.3	1.14	26
502	580.0	164.0	15.9	46.0	0	8	179.8	36.0	6.8	65.3	64.9	0.72	6
503	650.0	164.0	15.8	45.5	0	10	196.0	30.2	8.0	90.0	90.9	4.34	40
504	280.0	164.0	14.3	42.0	0	9	194.9	37.0	77.5	55.8	61.7	1.92	2
505	650.0	164.0	15.4	45.0	0	8	215.8	32.0	25.0	9.5	9.7	0.51	6
506	1973.0*	421.0†	14.6	42.5	0	14	250.2	29.7	29.4	76.4	82.7	0.82	48

* The mean occupational exposure at the working place.

† The weighted average exposures have been calculated from the data at the working place and from the average indoor and outdoor exposure at home.

TABLE B-13. RELATIONSHIP OF OCCUPATIONAL EXPOSURE TO BIOLOGICAL PARAMETERS

Lead Storage Battery Plant (Munja I)

Subject	Air*	Blood								Urine	
								Lead µg/100ml blood			
	Hb g %	Htc cm^3 %	BpE per 10^6E	Rtc %	G-6PD units per 100mlE	GSH mg per 100ml blood	ALAD units per 1mlE	original values	standard Hb adjusted values	ALA mg per 100ml	Corproporphyrin µg per 100ml
507	16.2	43.0	0	12	193.1	41.6	4.9	131.0	127.8	1.87	20
508	13.0	40.0	600	17	176.5	31.7	26.6	76.4	92.9	0.29	65
509	16.3	45.0	0	15	191.7	36.6	32.5	84.2	81.6	0 48	25
510	15.6	44.0	400	15	172.3	41.5	1.9	88.9	90.0	1.48	38
511	13.8	40.5	1400	21	162.2	26.1	37.3	96.7	100.7	4.00	116
512	13.2	40.5	1500	20	204.3	35.0	29.6	118.6	142.0	1.29	28
513	15.2	43.0	1800	19	209.8	24.1	2.9	127.9	133.0	2.41	36
514	14.3	42.5	1100	20	184.8	25.4	4.4	59.3	65.5	1.99	40
515	15.4	44.0	0	10	154.6	26.7	6.8	57.7	59.2	0.47	11
516	15.8	44.5	0	13	123.5	45.9	2.6	88.9	88.9	1.94	46
517	14.4	46.5	0	14	133.2	35.0	4.7	57.7	63.3	0.36	17
518	15.4	44.0	100	14	215.3	31.4	29.5	103.0	105.7	0.37	14
519	16.8	46.0	0	12	127.5	34.3	19.8	68.6	64.5	0.27	5
520	15.2	43.0	0	16	161.9	42.9	8.7	121.7	126.5	0.65	21

* Lead in air values not given since workers wear respirators.

(continued)

TABLE B-13. (continued)

Lead Storage Battery Plant (Munja I)

Subject	Air*	Blood								Urine	
								Lead µg/100ml blood			
	Hb g %	Htc cm^3 %	BpE per 10^6E	Rtc %	G-6PD units per 100mlE	GSH mg per 100ml blood	ALAD units per 1mlE	original values	standard Hb adjusted values	ALA mg per 100ml	Corproporphyrin µg per 100ml
521	16.4	44.5	0	14	163.6	41.3	3.8	79.6	76.7	1.02	27
522	16.0	45.0	400	17	204.2	43.2	3.3	71.8	70.9	1.43	27
523	14.1	42.0	800	17	223.2	33.7	2.3	86.0	96.4	1.15	39
524	15.1	44.0	1000	16	153.0	34.7	4.5	73.3	76.7	2.47	32
525	15.6	46.5	0	6	226.6	34.7	16.1	92.0	94.1	0.36	3
526	14.5	42.5	0	14	177.0	43.7	5.8	160.7	175.1	1.32	8
527	16.3	43.5	0	11	149.3	42.9	9.7	138.8	134.5	0.26	3
528	14.9	42.0	0	13	181.2	46.2	8.3	106.0	112.4	1.25	16
529	16.0	46.7	400	16	190.4	49.5	6.7	129.5	127.9	0.00	9
530	17.7	42.5	0	12	165.4	42.9	28.7	48.4	43.2	0.23	39
531	14.6	44.0	0	15	184.2	42.2	2.8	82.7	89.5	0.70	11
532	16.5	44.5	0	14	160.1	34.3	20.4	67.1	64.3	0.58	9
533	15.8	43.0	700	17	143.5	22.4	36.3	96.7	96.7	0.08	20
534	13.9	42.5	0	12	255.7	30.4	14.7	106.1	120.6	3.91	35
535	15.8	44.0	0	16	155.1	39.3	7.6	74.9	74.9	0.43	13

* Lead in air values not given since workers wear respirators.

(continued)

TABLE B-13. (continued)

Lead Storage Battery Plant (Munja I)

Sub-ject	Air*	Blood								Urine	
								Lead µg/100ml blood			
	Hb g %	Htc cm^3 %	BpE per 10^6E	Rtc %	G-6PD units per 100mlE	GSH mg per 100ml blood	ALAD units per 1mlE	original values	standard Hb adjusted values	ALA mg per 100ml	Corproporphyrin µg per 100ml
536	15.1	44.0	0	14	175.4	50.8	1.7	92.0	96.3	1.45	44
537	16.3	45.0	600	16	159.7	50.8	2.8	103.0	109.8	0.92	27
538	15.9	44.5	0	18	209.4	29.7	2.8	115.4	114.7	1.80	38
539	15.1	44.0	0	18	252.4	35.0	3.9	79.6	83.3	1.98	19
540	14.7	42.5	0	9	194.2	33.7	10.2	90.5	97.3	3.33	41
541	16.7	44.0	0	12	169.6	28.1	3.4	65.6	62.1	0.73	7
542	15.6	45.0	0	12	160.2	44.9	6.9	171.6	173.8	1.10	24
543	15.3	43.0	1100	15	146.9	40.6	4.6	79.6	82.2	1.44	39
544	13.7	41.0	900	19	154.8	28.1	3.4	74.9	86.4	3.60	65
545	16.0	44.5	0	13	174.0	31.4	1.9	60.8	64.0	0.51	5
546	16.2	43.0	0	18	168.6	47.9	30.9	121.7	118.7	0.23	27
547	14.1	41.5	700	17	212.5	36.3	32.1	123.2	138.1	0.32	14
548	15.3	43.0	0	16	202.2	41.3	36.3	140.4	145.0	1.32	36
549	13.9	39.5	800	30	250.2	34.7	51.3	62.4	70.9	0.60	49
550	14.9	42.5	600	18	244.8	34.7	28.7	29.6	31.4	0.00	15
551	16.0	44.2	900	19	182.0	44.2	7.4	67.1	66.3	1.06	42
552	14.2	42.0	500	13	220.3	47.5	5.5	54.6	60.8	0.74	20
553	15.7	44.0	0	13	165.4	34.3	30.4	90.5	91.1	0.72	12

*Lead in air values not given since workers wear respirators.

TABLE B-14. RELATIONSHIP OF OCCUPATIONAL EXPOSURE TO BIOLOGICAL PARAMETERS

Lead smelting plant (Mezice)

Sub-ject	Air*	Blood								Urine	
								Lead µg/100ml blood			
	Hb g %	Htc cm^3 %	BpE per 10^6E	Rtc %	G-6PD units per 100mlE	GSH mg per 100ml blood	ALAD units per 1mlE	original values	standard Hb adjusted values	ALA mg per 100ml	Corpropor-phyrin µg per 100ml
554	13.6	42.5	100	18	156.1	33.7	4.1	33.6	39.0	1.95	116
555	15.7	45.0	1000	17	140.1	43.6	5.8	56.9	57.3	2.07	15
556	14.9	44.0	700	18	144.5	45.5	3.7	42.2	44.7	1.11	7
557	14.6	43.5	2800	21	151.1	40.9	3.2	46.6	50.4	3.68	183
558	13.3	42.0	900	18	152.5	32.0	2.7	46.6	55.4	4.52	86
559	15.3	44.0	3000	27	156.0	38.9	4.3	38.0	39.2	4.72	51
560	14.0	42.5	1500	19	155.0	33.7	10.9	41.8	47.2	0.68	36
561	15.5	45.0	4200	24	157.5	37.6	2.2	65.5	66.8	2.91	107
562	12.9	40.0	3400	28	157.3	43.6	1.9	57.6	70.5	5.07	175
563	13.9	42.5	5000	37	157.9	40.2	1.8	52.4	59.6	2.55	192
564	16.5	46.0	1000	18	181.0	44.9	4.1	40.4	38.7	2.57	67
565	15.5	44.5	4400	29	142.0	43.6	2.8	65.1	66.4	8.99	59
566	13.6	42.0	300	14	177.4	43.2	6.5	55.9	65.0	1.69	168
567	15.1	42.0	3000	23	158.5	32.0	7.7	53.1	55.6	3.68	201
568	12.9	40.0	3200	29	164.6	35.3	6.9	54.5	66.8	8.01	525

*Lead in air values not given since workers wear respirators.

(continued)

TABLE B-14. (continued)

Lead smelting plant (Mezice)

Subject	Air*	Blood								Urine	
								Lead µg/100ml blood			
	Hb g %	Htc cm^3 %	BpE per 10^6E	Rtc %	G-6PD units per 100mlE	GSH mg per 100ml blood	ALAD units per 1mlE	original values	standard Hb adjusted values	ALA mg per 100ml	Corproporphyrin µg per 100ml
569	15.2	46.0	500	15	184.0	41.2	7.3	39.1	40.6	3.80	60
570	14.7	45.0	4200	30	171.8	44.2	8.9	54.8	58.9	2.84	23
571	16.1	46.0	3200	26	167.8	38.6	6.0	67.5	66.2	3.68	95
572	15.5	46.0	400	16	158.4	40.2	9.2	47.6	48.5	8.12	7
573	14.0	41.5	1800	20	150.1	39.6	4.8	42.5	48.0	1.65	130
574	15.9	46.5	800	18	200.4	43.6	7.3	33.6	33.4	1.49	20
575	13.7	42.5	3200	24	178.3	38.9	4.7	67.5	77.8	2.68	55
576	15.7	45.0	400	14	144.2	34.3	10.8	46.3	46.6	1.41	37
577	14.9	42.5	4800	31	165.6	39.9	5.3	58.3	61.8	3.81	211
578	15.7	45.5	2900	21	159.2	35.9	5.8	45.9	46.2	2.00	32
579	14.1	44.0	1100	16	152.5	41.9	6.0	51.4	57.6	3.11	102
580	15.9	45.5	300	12	149.3	45.5	7.1	38.0	37.8	1.36	67
581	13.6	42.0	3900	26	159.1	36.9	0.9	50.7	58.9	0.74	21
582	15.2	43.5	2100	19	176.8	35.9	12.9	42.2	43.9	0.81	17

(continued)

*Lead in air values not given since workers wear respirators.

TABLE B-14. (continued)

Lead smelting plant (Mezice)

Subject	Air*	Blood							Urine	
								Lead µg/100ml blood		
	Hb g %	Htc cm^3 %	BpE per 10^6E	Rtc %	G-6PD units per 100mlE	GSH mg per 100ml blood	ALAD units per 1mlE	original values	standard Hb adjusted values	ALA mg per 100ml	Corproporphyrin µg per 100ml
583	15.0	44.0	3500	28	149.9	36.6	31.	69.6	73.3	2.65	123
584	14.3	42.5	400	14	156.1	39.2	2.9	63.7	70.4	1.37	100
585	11.8	39.5	7200	42	176.4	32.0	2.5	65.8	68.1	5.56	142
586	9.2	36.0	5000	35	183.7	40.2	3.8	66.1	113.5	5.52	265
587	9.0	36.0	2500	21	200.6	37.6	3.1	43.2	75.8	4.86	96
588	14.4	43.0	1000	17	162.9	41.9	1.7	53.5	58.7	0.74	78
589	14.0	42.5	1500	18	189.9	43.8	12.1	55.5	62.6	0.97	48
590	14.0	43.5	600	15	150.1	45.2	3.2	66.1	74.6	1.31	34
591	13.5	42.0	3100	24	149.0	36.6	4.5	58.9	68.9	3.10	33
592	14.7	44.5	7800	60	178.8	34.0	4.2	89.8	96.5	4.52	107
593	15.4	44.0	2500	21	181.9	46.5	4.0	59.3	60.8	0.91	75
594	15.7	45.5	500	14	198.1	36.3	4.7	54.5	61.0	3.93	180
595	14.2	43.5	2800	23	170.5	40.9	5.2	62.0	69.0	3.39	80

*Lead in air values not given since workers wear respirators.

(continued)

TABLE B-14. (continued)

Lead smelting plant (Mezice)

Subject	Air*	Blood								Urine	
								Lead µg/100ml blood			
	Hb g %	Htc cm^3 %	BpE per 10^6E	Rtc %	G-6PD units per 100mlE	GSH mg per 100ml blood	ALAD units per 1mlE	original values	standard Hb adjusted values	ALA mg per 100ml	Corproporphyrin µg per 100ml
596	15.2	46.5	700	16	146.6	47.2	8.6	39.8	41.4	1.10	36
597	16.3	47.0	300	14	154.8	37.2	9.3	65.5	63.5	2.78	117
598	15.5	45.5	2600	24	161.5	33.0	4.4	64.4	65.6	1.43	33
599	14.2	44.0	2800	26	192.1	36.9	8.2	51.8	57.6	0.84	35
600	13.4	43.5	400	14	198.8	35.6	2.9	48.0	56.6	6.40	250
601	13.9	44.5	3500	27	160.8	39.6	1.4	73.7	83.8	6.34	35
602	14.6	44.5	800	16	156.4	36.9	2.8	46.3	50.1	2.46	85
603	14.0	44.0	1200	16	161.1	35.6	3.4	69.2	78.1	2.81	165
604	12.4	42.0	2800	20	186.1	32.7	2.1	54.8	69.8	4.98	213

*Lead in air values not given since workers wear respirators.

TABLE B-15. BIOLOGICAL PARAMETERS BY GROUP

Hemoglobin

Hb	.881+02	.104+03	.121+03	.137+03	.153+03	.170+03	.186+03	Total
Group								
1	0	0	1	14	77	41	8	141
2	1	0	2	29	108	70	1	211
3	0	0	1	12	25	26	10	74
4	2	1	4	53	97	21	0	178
Total	3	1	8	108	307	158	19	604

Coefficient of correlation R = -.2317

Kruskal-Wallisova Statistics Test H = .67510+02

TABLE B-16. BIOLOGICAL PARAMETERS BY GROUP

Basophilic stippled cell count

BpE	.433+03	.130+04	.217+04	.303+04	.390+04	.477+04	.563+04	.650+04	.737+04	Total
Group										
1	137	3	1	0	0	0	0	0	0	141
2	177	28	4	2	0	0	0	0	0	211
3	40	11	11	6	5	1	0	0	0	74
4	40	29	11	16	6	5	0	0	2	109
Total	394	71	27	24	11	6	0	0	2	535

Coefficient of correlation R = .5141

Kruskal-Wallisova Statistics Test H = .2068+03

TABLE B-17. BIOLOGICAL PARAMETERS BY GROUP

Reticulocyte count

Rtc	.844+01	.153+02	.222+02	.291+02	.359+02	.428+02	.497+02	.566+02	Total
Group									
1	115	23	3	0	0	0	0	0	141
2	88	91	28	3	0	0	0	0	210
3	5	39	23	5	1	1	0	0	74
4	21	110	31	12	2	1	0	1	178
Total	229	263	85	20	3	2	0	1	603

Coefficient of correlation R = .5249

Kruskal-Wallisova Statistics Test H = .20954+03

TABLE B-18. BIOLOGICAL PARAMETERS BY GROUP

Glucose-6 phosphate dehydrogenase activity

G-6PD	.134+04	.156+04	.178+04	.200+04	.222+04	.243+04	.265+04	Total
Group								
1	0	44	59	25	13	0	0	141
2	3	35	83	64	18	5	3	211
3	0	20	46	8	0	0	0	74
4	11	58	56	33	13	5	2	178
Total	14	157	244	130	44	10	5	604

Coefficient of correlation R = -.8011-01

Kruskal-Wallisova Statistics Test H = .30751+02

TABLE B-19. BIOLOGICAL PARAMETERS BY GROUP

Glutathione

GSH	.229+03	.299+03	.369+03	.438+03	.508+03	.578+03	.648+03	Total
Group								
1	10	28	52	36	12	3	0	141
2	5	43	135	26	2	0	0	211
3	0	8	38	19	7	0	2	74
4	4	42	86	41	5	0	0	178
Total	19	121	311	122	26	3	2	604

Coefficient of correlation R = -.3010-02

Kruskal-Wallisova Statistics Test H = .17383+02

TABLE B-20. BIOLOGICAL PARAMETERS BY GROUP

Delta-amino levulinic acid dehydratase activity

ALAD	.113+01	.148+01	.182+01	.217+01	.252+01	.287+01	.322+01	Total
Group								
1	0	0	0	0	2	17	122	141
2	0	0	0	14	37	115	45	211
3	0	1	10	28	29	6	0	74
4	9	43	55	35	34	2	0	178
Total	9	44	65	77	102	140	167	604

Coefficient of correlation R = -.8633

Kruskal-Wallisova Statistics Test H = .47427+03

TABLE B-21. BIOLOGICAL PARAMETERS BY GROUP

Logarithm of delta-amino levulinic acid dehydratase activity

log ALAD	.145+03	.417+03	.688+03	.960+03	.123+04	.150+04	.178+04	.205+04	.232+04	Total
Group										
1	0	2	1	14	23	35	37	21	8	141
2	15	46	76	29	24	15	5	1	0	211
3	47	21	6	0	0	0	0	0	0	74
4	152	25	1	0	0	0	0	0	0	178
Total	214	94	84	43	47	50	42	22	8	604

Coefficient of correlation R = -.8690

Kruskal-Wallisova Statistics Test H = .47427+03

TABLE B-22. BIOLOGICAL PARAMETERS BY GROUP

Lead-adjusted

Pb-adj	.973+02	.292+03	.486+03	.681+03	.875+03	.107+04	.126+04	.146+04	.165+04	Total
Group										
1	138	3	0	0	0	0	0	0	0	141
2	158	46	7	0	0	0	0	0	0	211
3	2	29	20	16	5	2	0	0	0	74
4	9	22	41	65	22	7	7	3	2	178
Total	307	100	68	81	27	9	7	3	2	604

Coefficient of correlation R = .8099

Kruskal-Wallisova Statistics Test H = .40494+03

TABLE B-23. BIOLOGICAL PARAMETERS BY GROUP

Logaritm of lead-adjusted

log Pb-adj	.791+00	.117+01	.155+01	.192+01	.230+01	.268+01	.305+01	Total
Group								
1	3	4	19	76	38	0	0	140
2	0	0	9	102	80	17	0	208
3	0	0	0	0	15	49	10	74
4	0	0	0	5	14	111	48	178
Total	3	4	28	183	147	177	58	600

Coefficient of correlation R = .7707

Kruskal-Wallisova Statistics Test H = .40341+03

TABLE B-24. BIOLOGICAL PARAMETERS BY GROUP

Delta-amino levulinic acid (in urine)

ALA	.499+02	.150+03	.250+03	.350+03	.449+03	.549+03	.649+03	.749+03	.849+03	Total
Group										
1	138	3	0	0	0	0	0	0	0	141
2	211	0	0	0	0	0	0	0	0	211
3	54	13	3	1	1	1	0	0	1	74
4	98	39	14	12	7	3	2	0	3	178
Total	501	55	17	13	8	4	2	0	4	604

Coefficient of correlation R = .4785

Kruskal-Wallisova Statistics Test H = .19040+03

TABLE B-25. BIOLOGICAL PARAMETERS BY GROUP

log ALA	.770+00	.111+01	.144+01	.178+01	.211+01	.245+01	.279+01	Total
Group								
1	0	4	50	83	4	0	0	141
2	3	25	136	47	0	0	0	211
3	0	2	11	37	17	4	3	74
4	1	5	34	52	37	32	14	175
Total	4	36	231	219	58	36	17	601

Coefficient of correlation R = .3622

Kruskal-Wallisova Statistics Test H = .19997+03

TABLE B-26. BIOLOGICAL PARAMETERS BY GROUP

Coproporphyrins

Copro	.190+02	.576+02	.953+02	.133+03	.171+03	.208+03	.246+03	Total
Group								
1	141	0	0	0	0	0	0	141
2	202	8	1	0	0	0	0	211
3	56	15	1	1	0	1	0	74
4	120	29	10	7	5	4	2	177
Total	519	52	12	8	5	5	2	603

Coefficient of correlation R = .3835

Kruskal-Wallisova Statistics Test H = .24697+03

TABLE B-27. BIOLOGICAL PARAMETERS BY GROUP

Logarithm coproporphyrins

Log Copro	.173+00	.519+00	.865+00	.121+01	.156+01	.190+01	.225+01	Total
Group								
1	2	27	94	18	0	0	0	141
2	1	6	58	112	29	5	0	211
3	1	2	5	36	22	6	2	74
4	1	2	24	57	55	24	14	177
Total	5	37	181	223	106	35	16	603

Coefficient of correlation R = .5910

Kruskal-Wallisova Statistics Test H = .24697+03

TABLE B-28. BIOLOGICAL PARAMETERS BY GROUP

Coproporphyrin isomer I

Copro 1	.993+01	.218+02	.336+02	.455+02	.574+02	.692+02	.811+02	Total
Group								
1	2	10	45	57	18	1	6	139
2	0	0	30	43	8	0	1	82
3	8	20	24	15	6	1	0	74
4	23	14	1	0	0	0	0	38
Total	33	44	100	115	32	2	7	333

Coefficient of correlation R = -.4776

Kruskal-Wallisova Statistics Test H = .11949+03

TABLE B-29. BIOLOGICAL PARAMETERS BY GROUP

Logarithm coproporphyrin isomer I

log Copro 1	.698+00	.889+00	.108+01	.127+01	.146+01	.165+01	.184+01	Total
Group								
1	0	1	1	6	34	85	12	139
2	0	0	0	0	19	57	6	82
3	0	0	6	12	31	22	3	74
4	5	0	17	13	3	0	0	38
Total	5	1	24	31	87	164	21	333

Coefficient of correlation R = -.4898

Kruskal-Wallisova Statistics Test H = .11949+03

TABLE B-30. RELATIONSHIP OF LEAD IN AIR TO ALAD*

Pb µg/100 ml	ALAD units/1 ml E 0-9.9	10-19.9	20-29.9	30-39.9	40-49.9	50-59.9	60-69.9	70-79.9	N	$\bar{x}$	SD	M
0- 9.9			1		1				2			30.0
10-19.9		1	2	4	2		1	1	11	39.5	17.5	36.3
20-29.9		6	6	2	3		2		19	30.2	16.1	25.8
30-39.9		5	1	4	2	1			13	29.6	13.9	31.3
40-49.9	2	3		4					9	21.6	13.2	18.3
50-59.9	1	6	1			1			9	19.4	14.2	15.8
60-69.9	5	4	1						10	11.0	7.0	10.0
70-79.9	2	1	1						4			10.0
80-89.9	2	1							3			7.5
90-99.9												
N	12	27	13	14	8	2	3	1	80			
$\bar{x}$	75.8	54.6	41.9	40.7	32.4							
SD	13.1	18.0	20.5	12.2	10.3							
M	74.0	55.0	35.8	42.5	33.3	50.0	32.5	25.0				

* All Meza Valley inhabitants

TABLE B-31. RELATIONSHIP OF ALA AND ALAD*

ALA mg/100 ml	ALAD units/1 ml E 0-9.9	10-19.9	20-29.9	30-39.9	40-49.9	50-59.9	60-69.9	70-79.9	N	$\bar{x}$	SD	M
0 -0.59	2	6	7	5	4	2	2	1	29	34.3	18.6	29.3
0.6-1.19		12	6	7	3		1		29	26.7	12.8	24.2
1.2-1.79	3	6							9	11.6	5.0	12.5
1.8-2.39	1	1		1					3			15.0
2.4-2.99	1								1			5.0
3.0-3.59		1							1			15.0
3.6-4.19												
4.2-4.79	1								1			5.0
4.8-5.99	1								1			5.0
6.0-7.19												
7.2-8.39	1								1			5.0
N	10	26	13	13	7	2	3	1	75			
$\bar{x}$	2.33	0.92	0.57	0.76	0.55							
SD	1.75	0.17	0.31	0.50	0.32							
M	1.80	0.95	0.56	0.73	0.53	0.30	0.75	0.30				

* All Meza Valley inhabitants

TABLE B-32. RELATIONSHIP OF ALAD TO COPRO*

ALAD units per 1 ml E	Copro µg per 100 ml												
	0-9.9	10-19.9	20-29.9	30-39.9	40-49.9	50-59.9	60-69.9	70-99.9	>100	N	$\bar{x}$	SD	M
0- 9.9		2		3	1		1	2	1	10	35.0	22.5	40.0
10-19.9	3	3	6	4	6	1	1	1	1	26	29.6	22.1	32.5
20-29.9	1	7	4	1						13	18.8	7.7	17.8
30-39.9	1	7	3	2						13	19.6	8.7	17.8
40-49.9	1	4	1	1						7	17.8	9.5	16.2
50-59.9	1	1								2			10.0
60-69.9		3								3			15.0
70-79.9		1								1			15.0
N	7	28	14	11	7	1	2	3	2	75			
$\bar{x}$	29.2	35.0	24.2	19.5	13.6								
SD	16.1	18.0	10.0	13.6	3.8								
M	25.0	32.8	22.5	16.3	14.2	15.0	10.0	7.5	10.0				

* All Meza Valley inhabitants

TABLE B-33. RELATIONSHIP OF ALAD TO RTC*

ALAD units per 1 ml E	Rtc per 1000 E												
	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	N	$\bar{x}$	SD	M
0- 9.9				2	6	4				12	23.3	3.6	23.3
10-19.9		1	7	10	7	1			1	27	16.6	5.8	17.8
20-29.9			9	4						13	14.0	2.4	13.6
30-39.9		1	3	5	4		1			14	18.2	6.1	18.0
40-49.9		2	3	3						8	13.1	4.2	13.3
50-59.9			1	1						2			15.0
60-69.9			3							3			13.0
70-79.9										1			23.0
N		4	26	25	18	5	1		1	80			
$\bar{x}$		35.0	31.5	25.0	19.4	7.0							
SD		14.4	16.3	13.3	18.0	4.5							
M		40.0	26.7	21.3	14.3	6.3	35.0		15.0				

* All Meza Valley inhabitants

TABLE B-34. RELATIONSHIP OF LEAD IN AIR TO ALA*

Pb µg/100 ml	ALA mg/100 ml 0-0.59	0.6-1.19	1.2-1.79	1.8-2.39	2.4-2.99	3.0-3.59	3.6-4.19	4.2-4.79	4.8-5.99	6.0-7.19	7.2-8.39	N	$\bar{x}$	SD	M
0- 9.9												2			0.60
10-19.9	1	1										11	0.46	0.28	0.41
20-29.9	8	3										17	0.72	0.35	0.75
30-39.9	6	10	1									13	0.76	0.56	0.66
40-49.9	6	5	1	1								9	1.23	1.08	0.98
50-59.9	2	4	2				1					8	1.12	0.54	1.05
60-69.9	1	4	2	1								8	0.75	0.53	0.60
70-79.9	4	2	2									4			2.70
80-89.9	1				1	1					1	3			1.50
90-99.9		1	1						1						
N	29	30	9	2	1	1	1		1		1	75			
$\bar{x}$	43.2	46.3	62.7												
SD	19.2	17.9	17.8												
M	39.2	42.0	62.5	50.0	85.0	85.0	55.0		95.0		85.0				

* All Meza Valley inhabitants.

TABLE B-35. RELATIONSHIP OF LEAD IN AIR TO COPRO*

Pb µg/100 ml	Copro µg per 100 ml												
	0-9.9	10-19.9	20-29.9	30-39.9	40-49.9	50-59.9	60-69.9	70-99.9	>100	N	$\bar{x}$	SD	M
0- 9.9													
10-19.9	1	1								2			10.0
20-29.9	2	7		2						11	16.8	9.8	15.0
30-39.9		7	7	3						17	22.6	7.5	22.1
40-49.9	1	6	1	2	2				1	13	28.0	21.3	19.2
50-59.9	2	1	2	3	1					9	25.0	14.4	27.5
60-69.9		2	3		2			1		8	33.7	20.3	26.7
70-79.9	1	3	1		1		1	1	1	9	38.3	30.0	25.0
80-89.9		1				1	1	1		4			60.0
90-99.9				1	1					2			40.0
N	7	28	14	11	7	1	2	3	2	75			
$\bar{x}$	42.1	42.8	47.8	45.9	63.5								
SD	21.3	18.7	14.9	19.7	17.7								
M	45.0	38.6	40.0	42.5	62.5	85.0	80.0	75.0	50.0				

* All Meza Valley inhabitants.

TABLE B-36. RELATIONSHIP OF LEAD IN AIR TO RTC*

Pb ug/100 ml	RTC per 1000 E 0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-35	N	$\bar{x}$	SD	M
0- 9.9													
10-19.9				2						2			18.0
20-29.9		1	3	4	2		1			11	17.5	6.7	16.9
30-39.9		1	10	3	4				1	19	16.7	7.6	14.3
40-49.9			6	6	1					13	15.6	3.3	15.4
50-59.9		1	1	4	2					8	18.1	6.2	17.5
60-69.9		1	2	4	2					9	16.4	4.8	17.5
70-79.9			1	4	1	4				10	21.5	5.6	20.0
80-89.9			1		3					4			21.7
90-99.9			1		1	1				3			22.5
N		4	25	27	16	5	1		1	79			
$\bar{x}$		35.0	45.4	47.5	56.2	78.9							
SD		18.2	18.3	18.7	23.6	8.9							
M		30.0	39.5	47.5	55.0	76.3	25.0		35.0				

* All Meza Valley inhabitants.

TABLE B-37. RELATIONSHIP OF ALA TO COPRO*

ALA mg/100 ml	Copro µg per 100 ml												
	0-9.9	10-19.9	20-29.9	30-39.9	40-49.9	50-59.9	60-69.9	70-99.9	>100	N	$\bar{x}$	SD	M
0 -0.59	5	19	1	1	1			1	1	29	19.8	17.6	15.0
0.6-1.19	2	8	12	6	1					29	23.6	9.5	23.8
1.2-1.79		1		3	4		1			9	40.5	13.3	41.3
1.8-2.39			1		1			1		3			45.0
2.4-2.99							1			1			65.0
3.0-3.59						1				1			55.0
3.6-4.19													
4.2-4.79				1						1			35.0
4.8-5.99								1		1			85.0
6.0-7.19													
7.2-8.39									1	1			
N	7	28	14	11	7	1	2	3	2	75			
$\bar{x}$	0.47	0.51	0.94	1.33	1.32								
SD	0.29	0.33	0.37	1.10	0.57								
M	0.42	0.44	0.90	1.05	1.43	3.30	2.10		0.60				

* All Meza Valley inhabitants.

TABLE B-38. RELATIONSHIP OF ALA TO RTC*

ALA mg/100 ml	RTC per 1000 E 0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-35	N	$\bar{x}$	SD	M
0 -0.59		2	11	11	1	2	1		1	29	17.2	7.4	15.7
0.6-1.19		1	16	10	3					30	15.0	3.7	14.4
1.2-1.79				2	6	1				9	21.9	3.0	22.1
1.8-2.39				1						1			18.0
2.4-2.99					2					2			23.0
3.0-3.59					1					1			23.0
3.6-4.19													
4.2-4.79				1						1			18.0
4.8-5.99						1				1			28.0
6.0-7.19													
7.2-8.39						1				1			28.0
N		3	27	25	13	5	1		1	76			
$\bar{x}$			0.65	0.85	1.59								
SD			0.30	0.79	0.84								
M		0.45	0.69	0.69	1.45	1.50	0.30		0.30				

* All Meza Valley inhabitants.

TABLE B-39. RELATIONSHIP OF COPRO TO RTC*

Copro µg/100 ml	RTC per 1000 E 0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-35	N	$\bar{x}$	SD	M
0- 9.9		1	2	4						7	14.6	3.9	15.6
10-19.9		1	10	10	4	2	1			28	17.3	5.6	16.5
20-29.9		1	8	4					1	14	15.7	8.2	13.8
30-39.9			4	3	4					11	17.5	4.5	17.5
40-49.9			1	3	3					7	18.9	3.8	19.2
50-59.9					1					1			23.0
60-69.9				1	1					2			20.0
70-99.9					1	2				3			26.2
>100			1			1				2			15.0
N		3	26	25	14	5	1		1	75			
$\bar{x}$			24.3	23.0	37.8								
SD			12.1	15.7	19.2								
M		15.0	21.2	18.5	37.5	72.5	15.0		25.0				

* All Meza Valley inhabitants.